THE ARTE OF NAVIGATION,

VVherin is contained, all the rules, declarations, secrets, and aduiſes, which for good Nauigation are *neceſſary, and ought to be knowen and practiſed,* and are very profitable for all kinde *of Mariners.*

Made by *M. Peter de Medina*, and dedicated to the right *excellent and renowned Lord*, Don Phillip *Prince of* Spaine, and of both Siciles.

VVith the Declination of the Sunne newly corrected.

Tranſlated out of Spaniſh into Engliſh, by *Iohn Frampton.*



¶ *Imprinted at London by* Thomas Dawſon, dwelling at the three Cranes in the Vinetree, *and are theſe to be ſolde.* 1595.

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To the right Worſhipfull M. Eaton Dier

Eſquier, I *ohn Frampton* wiſheth health and perfit felicitie, with increaſe of Honour.

CO*n*ſidering with myſelfe (right worſhipfull,) that friendſhip and bounden duetie doth force many times men to doe thinges, which if they were in the free choiſe of him that doth them, to leaue them vndone without any conceiued diſcurteſie, not onely he would not doe them, but alſo, not aſmuch as think of them. This I ſay that forced by friendſhip, and alſo moued by perſwaſion of certaine Pylottes and Maiſters of Ships, I determined to tranſlate this booke of the Arte of Nauigation, compiled by M. Peter de Medina a Spaniard, in the yere of our Lord Ieſus Chriſt 1545. And becauſe the worke is ſo principall, that in our time the like in all reſpects hath not beene ſet forth in our tung, conſidering it inſtructeth and teacheth all the whole arte of Nauigation in all points, and is in as like ſorte neceſſary for the Mariner, as the Accidence is for the Gramarian, the weapon for the Souldier, the toole for the workeman, the Guide for the blinde, the Inſtructor for the learner: and finally, comparable to a glaſſe, wherein all the courſe of the VVorld, the Seas, the VVindes, the altitudes of the Sun, Moone, and Starres, are to be ſeene and knowne, as faire as naturall reaſon may extend to. And beſides, the pleaſure that I minded to doe to the aforeſaid perſons, who moued me thereunto, as alſo to ſatisfie my good and continuall deſire which I haue, to helpe and bring to light this good and profitable arte of Nauigation, whereby all men that are deſirous to know the ſecret of this noble arte, may profite themſelues therewith, by reading it in our Engliſh tung, eſpecially the

Pylottes, Masters, and Mariners, considering their liues and liuinges doe stand thereupon. And seeing as I beleeue and trust they shall gather much fruite thereby, and that by little and little these sciences shall remaine aswel in our Countries, as in any other whatsoeuer: and seeing this worke so necessary for the common wealth, setting all other priuate busines aside, I tooke in hand to translate this booke, being perused and allowed by the chiefe Pilottes and learned Cosmographers of the famous contractation house of Seuil, for the increase and knowledge of matters of Nauigation for the subiects of Spaine: which work so excellent tried & approued by the learned, & for this our England so fit, and by me now thus translated out of Spanish into English, I dedicate to your VVorship before all others, for that I know you to haue the arte of Nauigation in high account, and as highly to esteeme all men that indeuour in the knowledge of the same, beseeching you to accept of my good will, and to be a protector of the same worke. And so desiring the almightie to giue your VVorship long life, and the aduancement in this common weale, that the good people wish vnto you, that authoritie may enable you to doe that good, that your good inclination doth naturally moue you vnto. From London this fourth of August. 1581.

Your Worships to commaund,
Iohn Frampton.

THE

THE EPISTLE DEDICATO-
rie, to the right excellent and renowmed Lord,
Don Phillip, Prince of Spaine, and of both Siciles, &c.
Set forth by M. Peter de Medina, the Authour of the Arte of Naui-
gation.

THe ſubiects are accuſtomed to ſerue their Lord right excellent and renowmed Prince and Lord, with that which ſeemeth to them to bee moſt conformable to their wil, and ſo ſome there be that ſerue with things that are delightful to the eye, and others to the taſte. Others there are which doe imploye their perſons in labours, and others in diuers other matters: And ſeeing I am deſirous to be of the number of thoſe, I ſought by what meanes I might put it in effect, and for that my abilitie is not ſufficient to doe greater ſeruice, I determined to make a booke of the Arte of Nauigation, and to offer it in the ſeruice of your higneſſe. Two thinges haue moued me to this moſt mightie Lord. The firſte is, to ſee how great ſeruice your highneſſe doth receiue by the Nauigation, as alſo how great profite cometh thereby to all the common wealth of Chriſtendome. And this being ſo, it appeareth that by the Nauigation, your Royall Senory is amplified and extended into ſo great parte of the Worlde. And that which is newlye diſcouered, is more then fiue thouſand leagues of the Sea coaſt, where doth containe ſo many regions, kingdomes, and prouinces, where are found ſo many nations and diuerſitie of people, and many other thinges in ſuch ſorte, by good reaſon it is called the new Worlde. So that by meanes of Nauigation there hath beene brought and is brought, into yonr highneſſe country of Spaine, ſo many Shippes laden with Golde and Siluer, that the ſumme thereof cannot be accompted, as alſo ſuch great quantitie of ſweete Drugges, and other thinges of great value and price. And this is little in reſpect, right excellent Lord, of the great number of people which doe ſaile, not onely to places knowne, but alſo to ſuch as are farre off and vnknowne, and of ſuch as is no knowledge of, they procure by ſayling to ſeeke and know. And ſeeing how long and dangerous waies they make by Sea, and fewe of them that ſaile, doe know what doth appertaine to the Arte of Nauigon. The cauſe is, there are no inſtructors thereof, nor books whereby they may attaine to it, ſo that your highneſſe may vnderſtand, although the Nauigation be of ſuch antiquitie, and more then three thouſand yeeres ſince it began, and a thing of ſuch importance, that the life of man goeth thereupon. And who can manifeſt the number of Shippes and people, which onely doe ſaile out of Spaine to all partes of the Worlde, or who can reckon the multitude of people which doe conſiſt onely vpon the Nauigation, with their goods, riches, trades, merchandize, and other thinges: and for all this, there are no maiſters which doe teach this Arte, nor knowledge of any that vnto this daye haue written the manner of ſayling. Euen ſo, the moſt ſorte of Pylottes haue the vſe

of Nauigation, no otherwiſe but euery one following his owne opinion and iudgment, whereof it happeneth many times in one Ship two or three Pylottes, the one ſaith according to his reckoning the Ship goeth ſayling vpon the land, the other ſaith according to his reckoning, the land is far of from him, and the cauſe thereof is, that there wanteth true knowledge of Nauigation, and hereby it happeneth many times both Shippes and people are loſt, and other ſuſtaine great dangers and loſſes. All which being by me conſidered, and chiefely ſeeing the Maieſtie of the Emperour, father vnto your highneſſe, and our Lord many times putteth his imperiall perſon vnto the danger of the Sea. Wherefore I being deſirous to ſerue your highneſſe in this, and to doe good to ſuch as are Sailers, by giuing them rules and aduiſes how they may make their Nauigation certaine, without hazarde of ignorance, I haue framed and deuiſed an Arte of Nauigation ſo orderly, that the Pilottes and other perſons which doe ſaile, ſhall finde themſelues ſo able therewith, that of it ſelfe or with very little helpe, they ſhall know and very plainely vnderſtand that which they treat of, ſeeing it is ſo neceſſary, and ſo much ſtandeth them vpon to know, as a thing which doth importe to many their honours, liues, and goods: Truth it is, moſt mightie Lord, that weying my ſtrength with the weight of my iudgment, and finding my ſelfe of ſmall ſufficiencie, I greatly diſputed with my ſelfe, if for my ſmall knowledge I ſhould holde my peace, ſeeing that I know it to be ouermuch boldeneſſe to make a worke and to direct it to your highneſſe, but animating my ſelfe, and truſting in your accuſtomed clemencie and magnanimitie, I put my ſelfe vnder the ſhadowe of your fauour, and ſo moſte humblye beſeeching you to receiue this my little ſeruice, with that royall curteſie that vnto others you are accuſtomed to doe. And being peruſed by your highneſſe, it may winne ſo much fauour, whereby it may paſſe ſafely through all places, yeelding great benefite and ſeruice vnto your highneſſe, as alſo profite to ſuch as vſe the Nauigation, that therby they may vnderſtand the perfect knowledge thereof.

A Pre-

A Preamble of the author vpon the Arte of Nauigation, wherein is declared the great *excellencie of the ſaid Arte.*

AMong all other vertues ſome are ſo much the greater, by how much it is communicated of amongſt others, whereby the vertue of Iuſtice is moſt perfit among other vertues, for it doth moſt communicate and participate withall, ſo that among all artes the Arte of Nauigation is more excellent then others, for it doth not onely communicate with them, but doth ſhut vp into it, the moſt principall of them, that is to ſay: Arithmetick, Geometrie, *and* Aſtrologie. *Theſe haue excellencie among the* Mathematicals, *by the moſt true ſhew that is made of their concluſions. And that this arte hath his beginning and greatnes among other artes, it appeareth by three reaſons following.*

The firſt, by reaſon of his ſubtiltie.
The ſecond, by reaſon of his certaintie.
The third, by reaſon of his profite.

For the firſt, who is ſufficient to ſpeake of ſo great a miſterie, that a man with a Compaſſe and certaine ſtrekes marked in a Carde, doth know how to goe round about the Worlde, and knoweth both by day and night whether hee ſhall come, and from whence he ſhall departe, and how much hee ſhall goe from one place to another, and that he goe certainly in his right way, by ſo long and ſo large a thing as the Sea is, where there is no way nor ſigne thereof, it is a miſterie very difficulte: and ſo it was conſidered by Salomon, *who ſaith, that one of the hardeſt things to be found, is the way of a ſhip in the Sea, for ſhe followeth not any way, nor leaueth any ſigne where ſhe went. And who is able to ſpeake of ſo great a ſecret, that with a round inſtrument no greater then the palme of a mans hand, called* Aſtrolabio, *the roundneſſe of the heauen is meaſured, being ſo great that the vnderſtanding of man cannot attaine thereunto: and therewith is taken the height of the Sunne, paſſing it by a very little and ſubtile*

place, being much greter then all the earth & the Sea, and it is known how nere and how farre off it is from vs: and in like maner the height of the Starres are taken, and by this we are so certainlie guided, that so much as one pointe faileth not. Likewise who can speake of the secrete and fineneſſe of the Compaſſe, that being made with as much paper as a mans hand, and with certaine ſtrekes marked thereon, doth note the windes, and with a litttle iron put into it, is made an inſtrument that doth moue of it ſelfe, with onely the naturall vertue that a ſtone hath giuen vnto it, and mouing without the helpe of any thing, ſheweth where is the East, the West, the North, and the South: and likewiſe the thirtie two windes which the Nauigation hath, and this it ſheweth not onely in one place but in all places, and it ſheweth it ſo certainlie, that thereby they do it, and are certaine of their purpoſe and pretence as many is are Saylers in the Sea.

For the ſecond, the certaintie of this Arte is ſo great, that it ſeemeth the knowledge of one man not to be ſufficient to ordaine it, nor yet of many men, more then God prouided a ſpeciall grace and vnderſtanding for that purpoſe, it is proued wherein it happeneth that a Pilotte commeth ſailing, and a ſtorme taketh him three hundreth leages in the Sea, and the daie verie cloudie, and the night ſo darke, that ſtanding in the Poope of the ſhippe, which is the hinder part, he ſeeth not the fore part of her, and ſcantlie the Maſt, and making manie turnes in the Seas, running from one part to another, riſing and deſcending, with a vehemencie of the windes and ſtrength of the Sea, and yet for all this by the certaintie of the arte, he knoweth the way where ſhe hath gone, and the place where ſhe is, and being come to the land, ſhe goeth to the Port although it be in the night, not ſeeing the land, likewiſe it happeneth many times, as the Pilotte goeth ſayling, he findeth a rocke or ſhoolde two hundreth leages in the Sea from any land, and marketh the place where he is, although he ſeeth not wherwith to marke it, for he ſeeth but the Heauen and the water, and in it is not any thing wherewithall to marke or make any ſigne, becauſe all doth moue, but marketh it in his Carde by the land he ſeeth in it, and according to the arte which the Carde hath, it is ſo certaine, that he and others both by day and night doe know how to preſerue and keepe themſelues from that place, going aſide from it becauſe they would receiue no hurt, although it be vnder the water, that nothing of it is ſeene, whereby is concluded that although the other artes haue trueth, this hath more by reaſon of the demonſtration ſo certaine, which ſheweth to keepe a man from hurt and danger that he ſeeth not.

For the third, I ſay there is no arte of any that man vſeth, ſo profitable nor ſo good as this art of Nauigation is, and this to be true it ſeemeth well, becauſe by it we haue knowledge of diuers and ſundry things in the worlde, and alſo of the trade with all partes of the worlde: and if Nauigation ſhould ceaſe, men ſhould bee driuen to line ſtraightlye, for that they ſhould lacke many thinges

which

which are necessarie for the life of man.

Also here is to be noted, that among all artes which men doe vse and practise, none is of so great perill and labour as the arte of Nauigation, and chiefely in these dayes, seeing it is so greatly encreased and well neere the whole roundnes of the worlde is sailed about: it is strange to consider that the auncient writers neither saw it, nor thought of it, but rather helde it for vnpossible: it is worthie to be noted, that I haue seene many times a Pilotte come from the East India, who hath beene one yeere vpon the waye, and from our Indias foure or fiue moneths, passing such great dangers and troubles, that many times they haue beene at the point of death, and being come home to their naturall countrie, all hath beene so forgotten of them, as if it had past in a dreame, and so they procure to returne with so great good will, as though they went to a thing of pleasure. I thinke that couetousnesse of goods is not the cause thereof, nor any other worldly gaine, but I take it to come of the Will of God, that although it be a thing so naturall to feare death, and great labour, yet all these labours and feares which they passe in the same Nauigation, are by them forgotten, for if they should remember and feare them, there is none that would saile on the Sea: And seeing the wise Pilotte that so oftentimes putteth his life in hazarde, and not onely his owne, but in his knowledge is put in trust the liues and goods of many: wherefore if any person will vnderstand the arte of Nauigation, let him peruse this booke and arte, and studie therein, and he shall finde all things set forth necessary for the same, whereby pleasing God, he will graunt to his way the end which he desireth.

The

The Table of the Chapters that are contained in the Arte of Nauigation.

The first booke treating of the Worlde, of his order and composition.



Cap. 1. What thing the Worlde is, and how it is compounded of the heauens & Elements, it declareth the number of the heauens, and their mouings.

Cap. 2. Wherein is declared the three mouinges which the eight heauen hath, and how they are knowne.

Cap. 3. How the heauen hath a round figure or shape, and by 5. reasons how it was conuenient it should be so.

Cap. 4. Of the noblenes of the heauen, and of his colour.

Cap. 5. Of the tenth heauen, called the first moueable, and of his mouings.

Cap. 6. Of the ninth heauen called *Christaline* or heauen of water, it declareth how there is a heauen of water, and of his qualitie.

Cap. 7. Of the eight heauen, which is the firmament or the starrie heauen, and the light of the starres, and their greatnes.

Cap. 8 How it is vnderstoode that the Sunne doth enter into the signes, and the cause wherefore they haue the names of beastes.

Cap 9. What thing a signe is, and what likenesse it hath with that which it is compared vnto, and what day of the yeare the Sunne entreth into euery signe.

Cap. 10. Of the seauen heauens, of Planets, and of their mouings, and how they make impression, and cause generation and corruption in the lower bodies.

Cap. 11. Of the elementall region, and how it is deuided into 4. elements.

Cap. 12. How those elementes doe shut vp one another, and why the water doth not couer all the earth.

Cap. 13. How the earth and the water both elements, doe make one round body.

Cap. 14. How the earth is scituated in the middest of the worlde.

Cap. 15. How the earth is quiet and moueth not,

Cap. 16. Of the foundation of the earth, and how it may be saide that the earth is the foundation of the worlde.

The second booke, of the Sea and his mouinges, and how the Nauigation was inuented.

Cap. 1. What thing the Sea is, and wherefore it was called Occean.

Cap. 2. How the Sea doth appertaine to the perfection of the worlde, and without it the worlde would perish, and how the water is ingendered in it.

Cap. 3. By what meanes the water of the Sea is salte, and how it is more conuenient it should be so, and better for the Nauigation.

Cap. 4. Of the difference of mouinges which the Occean Sea hath.

Cap. 5 What the cause is that the Sea neuer ouerfloweth aboue her bounds, nor is augmented.

Cap. 6. Of the excellencie of Nauigation, and the antiquitie thereof.

Cap. 7. How that by some tokens of the Sunne and Moone shalbe known when will come any tempest.

Cap. 8 Of the fiers and lights that appeareth in Shippes which doe saile, when there is any storme.

Cap 9. Of other certaine signes, whereby may be knowne when stormes will happen in the Sea.

The second booke, of the windes, their qualities and names, and how we ought to saile with them.

Cap. 1. What thing the winde is, and of what qualitie, & how it is ingendered.

Cap

m.r to read the 3. booke before the 2.

Cap. 2. How the winde doth not moue right vp nor downe, nor contrariwiſe, but his mouing is in circle manner, of water and earth.

Cap 3. Wherefore the winde is not alwaies equall alike, but at ſometimes more vehement, at other times calm, and wherfore it moueth to contrary place.

Cap. 4. Of the whirling of the winde, and what is the cauſe thereof.

Cap. 5. Of the windes which are named in the Cardes of Nauigation, and of the number of them, and their names.

Cap. 6. How the windes contained in the Cardes of Nauigation, doe compaſſe about the roundneſſe of the worlde for to ſaile by them.

A Carde to ſaile by, wherein is contained the Nauigation of the moſt parte of Europe, Affrica, and Indias or new world, with the diſtance of leages and height of degrees that euery thing hath.

Cap. 7. Of the order that the Cardes of Nauigation hath.

Cap. 8. Of the account which the Pylotte ought to haue of his way, when hee ſayleth with a winde that differeth from his courſe.

Cap. 9, How the Pylotte ſhould know ſayling by any maner of courſe, where the Meridian is.

Cap. 10. Wherein is largely diſcourſed this rule aboue written.

Cap. 11. How the Pilot ought to chooſe his courſe for the place whether he mindeth to ſayle.

Cap. 12. How hee ought to pricke his Carde, to know the place where the Ship is in.

Cap. 13. How the Pylot ought to know that his carde is iuſt & certain, that there be no errour in his Nauigation.

Cap. 14. Of the number of leages that is counted for a degree in euery courſe of the Nauigation.

Cap. 15. Of the number and meaſure, and of how many partes euery degree is compounded.

CAp. 1. Wherein is declared 17. chiefe principles, which ought to be known in the height of the Sunne.

Cap. 2. Of the excellencie of the Sun, and of his mouings.

Cap. 3. Of the yeare when the Sunne goeth in his circle, and of other maner of yeares, and how the leape yeare is counted,

Cap. 4. What thing a ſhadowe is, and how the ſhadowes ought to be looked on which the Sunne maketh for to take his height.

Cap. 5. Wherin is declared what thing is the height of the Sun, and how it ought to be taken to know the place wherein a man is.

Here followeth the rules of the height of the Sunne.

THe firſt rule when the Sun and the ſhadow goeth toward the North.

The 2. When the Sunne is at the North, and the ſhadowe at South, and the declination and height is more then 90. degrees.

The 3. When the Sun is at North, and the ſhadowes at the South, and the declination and height is iuſt 90. degrees.

The 4. The Sun at the North, and the ſhadowes at South, and the height and declination come not to 90. degrees.

The 5. The Sunne in the Equinoctiall, and the height to be leſſe thē 90. degrees.

The 6. When the height is taken in 90. degrees, and whether there be any declination in the Sunne or no.

The 7. When the Sun and the ſhadows goeth to the South.

The 8. The Sun at South, and the ſhadowes at North, and the declination and height are more then 90 degrees.

The 9. The Sunne at South and the ſha-

shadowes at North, and the height and declination are 90. degrees iuſt.

The 10. The Sunne at South, and the ſhadowe at North, and the height and declination come not to 90. degrees.

Cap. 6. By the rules of the height of the Sunne, the degrees are to be learned, a man is of one ſide or parte of the Equinoctiall line, more then of any of the other partes.

Cap. 7. Wherefore all the rules of the height of the Sunne are reduced into 90. degrees more then any other number.

Cap. 8. VVherefore doe we ſay that a man is from the Sunne the degrees that are taken in the Aſtrolabio, leſſe then ninetie.

Cap. 9. How it is vnderſtoode that a man hath the Sunne vpon his head.

Cap. 10. How to know the height of the Sunne, it muſt be ſeene whether it be a leape yeare, or what yeare it is.

A rule to know the leape yeare.

Tables of the declination, or a departing that the Sunne maketh from the Equinoctiall line, in euery daye of the foure yeares, as well to the North part, as to the South.

A Kalender of the Saints daies through the whole yeare, with a declaration of the principall feaſtes.

A rule to know the Dominicall letter euery yeare.

Cap. 11. How that by the Kalender aboue written, a man ſhall know the month and the day wherein he is.

The fifth booke, of the height of the Poles.

CAp. 1. What thing a Pole is, and how among the Poles the roundneſſe of the worlde is deuided.

Cap. 2. How the height of the Pole Artick is to be taken, and the cauſe wherfore he is taken.

Cap. 3. How the account is to bee vnderſtoode which is taken of the Pole Artick, or North.

Cap. 4. Of the North Starre, and of the gwards, and of his mouing.

Cap. 5. That according vnto the courſe the gwardes are in, ſhalbe known how many degrees the North ſtarre is vnder or aboue the Pole.

Cap. 6. How the rules of the height of the North ſtarre ought to be applied, and how they ought to be added vnto, or taken away, according to the place where the gwardes are.

Cap. 7. VVherein is declared certaine doubtes that in this mouing of the North ſtarre may be had.

Cap. 8. How the height of the North ſtarre may be taken, although the gwards be not ſeene.

Cap. 9. How the altitude of the North ſtarre may be taken, although the Horizon be not ſeene.

Cap. 10. A clocke by the North ſtarre, whereby is knowne what houre of the night it is in any time or place a man is in

Cap. 11. How the height of the Pole Antartick ſhould be taken.

The ſixt booke of the Compaſſes to ſaile by.

CAp. 1 Of the compaſſes of Nauigation, & of the defects they may haue, and how they may be amended.

Cap. 2. How the windes of the Compaſſe may be vnderſtoode, and how the Sunne paſſeth by them euery day.

Cap. 3. Wherein is declared the opinion had of the Northeaſting and Northweſting of the compaſſes.

Cap. 4. Of the inconueniences that may followe by the Northeaſting and Northweſting of the compaſſes.

Cap. 5. Of the regarde or allowance which the compaſſes of nauigation haue, and how it ought more to be giuen them.

Cap. 6. Of an inſtrument whereby the compaſſes may be marked and knowne if they be true.

The

The ſeuenth booke, of the Moone, and how her increaſing and diminiſhing doth ſerue in the Nauigation

CAp. 1. What thing the Moone is, and wherefore her light is not alwaies equall, but continually it increaſeth or diminiſheth.

Cap. 2. Of the golden number, and how it amounteth from one to nineteene, and wherefore no more nor leſſe.

A rule to know the golden number of euery yeare.

Cap. 3. Wherein is declared the daye and houre that the Moone maketh coniunction in euery moneth of the yeare for euer.

Cap. 4. Of the ſhorte account or reckoning without any booke, to knowe in ſhott time how many daies old the Moon is, in any moneth of the yeare.

Cap. 5. How by the dayes of the Moon and the courſe where the Sunne ought to ſtand, may be knowne in what howre the Tide will come.

Cap. 6. VVherein is declared more at large the Chapter aboue, with a ſhew thereof.

Cap. 7. How that by the houre wherein the coniunction was, ſhalbe taken out the tide, and the regarde or allowance that ſhalbe giuen to the Riuers.

The eight booke, of the dayes of the yeare.

CAp. 1. What thing a day is, and how it is reckoned, and in how many partes it is deuided.

Cap. 2. How that in all the artificial day the Sunne riſeth and ſetteth different vnto ſuch as dwell in the worlde.

Cap. 3. How that vnder the Equinoctiall, the daies and nightes are alwaies equall.

Cap. 4. How the dayes and nightes goe alwaies increaſing or diminiſhing vnto ſuche as dwell out of the Equinoctiall line.

Cap. 5, How that the increaſing and diminiſhing of the day, is not equall in all places.

A Table of the howers and minutes that ſuch as dwell in any diſtance from the Equinoctiall line, haue in the greateſt day of the yeare.

Cap. 6. Of the houres & minutes which they haue euery day of the yeare in the height of 40. degrees.

Cap 7. Of the houres and minutes that the Sunne doth riſe and ſet, euery daye in the yeare.

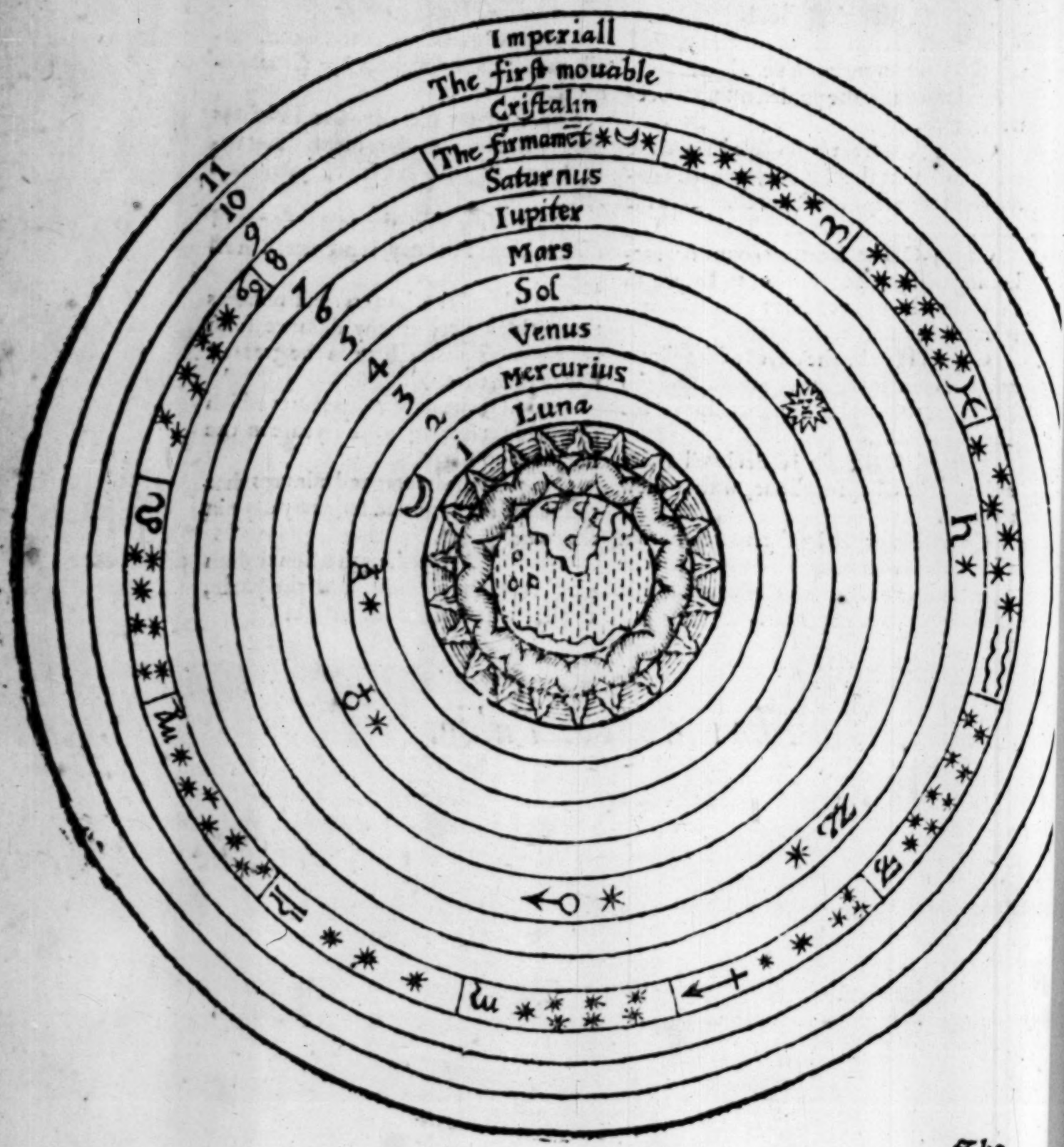
The laſt Chapter, how the Sunne doth giue his light in equall time of the yeare, to all ſuch as dwell in the worlde.

The end of the Table.

The

The firſte Booke of the worlde, his order and Compoſition.

The firſt Chapter, what thing the Worlde is, how it is compounded of heauens and elements, the number of the heauens are declared and their mouings.



The

THe World according to the Philosophers, is vniuersall, for all things, it containeth therein, the heauens, the starres, the earth, and the Sea, with all the other elements, and altogether is called the World. For as Ptholomie saith, it is alwaies mouing and hath no time of rest: seeing this vniuersalitie which we call World, is compounded and ordeined into two distinct regions (that is to say) the region Celestiall, and the region Elementall.

The first, which is the region Celestiall, is altogether shining, voide and free from all variation, alteration and corruption: this according to the opinion of some auncient authours, is deuided into nine heauens, (that is to say) seauen of the Planets, the eight is the firmament where the fixed Starres are, the ninth the first moueable, of that opinion was Ptholomie the great, and after him Thebit, Alfragano, Albategni, and others, which in Astronomie did flourish: more the late Astronomers (that is to say) the wise King Don Alonso, Iohn de Liueris, George Purbachio, Iohn de Monte Rey, and others doe hying it very probable.

That vpon the ninth sphere there is another tenth, which is the first moueable, it is alone, and they proue that there are tenne heauens, moueable by the mouings of the eight heauen. Hereof is written vpon the first Chapter of the Sphere, that the late Astronomers saw fixed starres in the heauen to haue three mouings, which were found in the eight Sphere, which are these following: one is the first moueable, that is to say, of the tenth Sphere which is the mouing of euery day, the which in foure and twentie houres maketh a reuolution from the East to the West, and this is made vpon the two Poles of the World, Articke and Antarticke.

It hath another mouing of the ninth Sphere, and is called the second moueable, for it is alwaies according to the succession of the signes from the West vnto the East, against the mouing of the first moueable, which mouing is made vpon the Poles of the Zodiac, and this according as King Don Alonso saith, is called Auge of the fixed starres, the third mouing is of himselfe, and is called the mouing of tripidation, or according to the saying of the said King, the mouing of accesse and recesse of the eight Sphere, and is made vpon two little circles in the concauety of the ninth Sphere, in the beginning of Aries and Libra, equally described in such sorte, that as to euery one of the heauens should not be giuen more then one mouing of it selfe, and the eight heauen should haue three mouings.

Hereof it commeth, that two of them are vnproper to him, but are caused of other two superiour heauens, that is to say, of the ninth and tenth, vpon these ten heauens or moueable Spheres we put the eleuenth, which according to the learned, is called the imperiall heauen, that is by reason of his great:

great brightnes, which alwaies continueth firme in one manner of order, without any mouing, and of this there are some reasons, whereby we are perswaded, whereof there are two things noted.

The first is, that any manner of thing that moueth from a place, moueth his place either in all, or in parte, so that which doth moue moueth into some place, for otherwise it were immoueable: therefore any of the moueable heauens moueth place either altogether in himselfe or his partes, therefore he is in some place, but not in any inferiour sphere, for the place must compasse about that which is put into the place, therfore he is in a superiour Sphere, and it is conuenient that there be some heauen stedfast and greater, wherein it may moue.

The second reason is, that there is put a difference in the heauen, that is to say, before and after, on the right side and on the lefte, not in respect of as much as toucheth vs, but for the nature of the thinges, so the Philosopher saith in the second of the heauen and the worlde, this cannot be preserued by the moueable spheres, the cause is that in the moueable spheres the part that now is at the right side, shalbe at the lefte: and the parte that is now abone, shalbe vnderneath, as experience sheweth: whereupon it followeth, that it is conuenient there be a fired heauen, which in the behalfe of the thing, is found the difference that is alleadged. This is the imperiall heauen, as it is saide. which is higher then all other heauens: it hath great dignitie by reason of his brightnesse, cleannesse, estabilitie, and pureneſſe, heere is the Celestiall court, where they dwell that are of good fortune, enioying of God, whereas the Apostle saith, nor eye hath seene, nor eare hath heard, nor can enter into the hart of man, that which God hath made ready for such as loue him.

The second Chapter, wherein is declared the three mouinges which the eight heauen hath, and how they are knowne.

I Haue saide in the Chapter before, that in the eight heauen are found three moungs different, and that some Astronomers were of opinion, that there were onely nine Spheres moueable, and others had opinion of temne, and because that in this the auncient authors and late writers doe not agree, I will shew you the reasons: that were of these opinions, of the which is to be vnderstoode: the first Astronomers maintained that there were onely eight heaaens, this they obteined by the mouing of the starres, for the starres moue not of themselues, but in their circles, so saith the Philosopher in the second of the Heauen and the Worlde, that the starres are fired in the circle, as the knot in the Table, so that by their mouinges the difference that is betweene the Planets which moue and the fired starres are knowne: these in their moning are knowne to be different the one from the other, in swiftnesse, and in slowneſſe,

slowneſſe, and by their place, but the fixed starres are so many in number, that they cannot be comprehended.

The long experience and obseruation of the Astronomers, attained to the knowledge that all doe moue together in equall distance and neerenesse, and continually the one doth keep with the other, so that their mouing is one, so the Philosopher vnderstandeth in the firste of the Heauen and the Worlde, therefore I say that these Astronomers vnderstoode that in the eight heauen was onely the continuall mouing that is from the East to the west, and that this was the first moueable, it seemeth that the said Philosopher did so vnderstand it in that place before alleadged, where he saith, that all the fixed stars are in the first moueable, and for this reason there are so many there, and in euery one of the inferiours no more but one.

There was other Astronomers that were not content to put onely eight spheres, but they attained to the ninth: and the reason was, because they saw the eight heauen to haue two mouings different, the one is as aforesaid from the east to the west, and the other contrary to it: that is to say, from the West into the east, and this motion is so slowe, that in a hundred yeares it is scarsely to be perceiued.

This mouing Pcholomie declareth in the seauenth of the Almagesto, with most strong and certaine reasons, so that these two different mouings being considered, they came to the knowledge, that the eight heauen was not the first moueable, for the first moueable hath one only mouing of himself most simple: the late Astronomers by their large speculation found fixed starres which moued sometimes from the West to the North, and to the South, and more swiftely to the East then to the West, and at other times more swiftely towards the North then to the South. The which demonstration because with onely two mouings aforesaid it could not be determined, they put another third mouing, and this is one of himselfe, which is made in two small circles in the head of Aries and Libra, so that as the eight sphere hath three mouinges, it is not onely necessary to put the ninth, but also the tenth: the reason is, because one simple body ought to haue but one onely simple mouing, and that is vnto him proper and naturall, so saith the Philosopher in the first of the Heauen and Worlde, if they haue any more mouinges, they are improper to him.

And seeing that the eight heauen is a simple bodye, as the Philosopher vnderstandeth it in the same place, it is conuenient that of these three mouings one of them be proper and naturall to him, and the other two improper. Likewise the mouing that is not proper to him, vnto another is proper and naturall.

And seeing that it is not an inferiour sphere, it is cõuenient to graunt that vpon the eight heauen are other two mouinges, of whome is caused these

thus moūinges aboue laide, so that as the Philosopher saith, the eight heauen was the first moueable. It is to be vnderstoode, that he and the Astronomers of his time, beleeued that the eight heauen had onelye the mouing of euery day, and they came not to the knowledge of others, because they were not determined vpon, but in a very long continuance of time.

The third Chapter, how the heauen hath a round figure, and of fiue reasons why it was conuenient it should be so.

The wisedome of ỹ euerlasting father which created & disposed al things, ordeined that the heauen should be round by these reasons following.

The first, by reason of the similitude.

The second, by reason of the commoditie.

The third, for necessitie.

Unto the first, touching similitude or likenesse, because the sensible worlde is made vnto the likenes of the worlde immaginatiue, wherein is no beginning nor ending, and for this cause the sensible worlde hath a forme or figure after the manner of a Sphere, in the which cannot be alligned or marked beginning nor ending.

For the second, of the commoditie or profite, this is because in all bodies and Superimetros, the which are foure principally, Oual, Piramidal, Colunal, Circular, the Sphere is of greater body, and of all figures the round figure or forme doth contain most, & seeing that the round body is the greater, it followeth that al things which haue that forme or shape, are profitable in ỹ worlde.

The third, which is of necessitie, for if the worlde were of another forme or shape then round, as like vnto a Triangle, or Quadrangle, or of another forme, it would follow that some place should be emptie, or some bodye without a place, therefore an emptie place cannot be put according to nature, for nature it selfe doth abhorre it so much, that more eaſily it consenteth ỹ which is heauie to rise vp, or that which is light to descend, then to permit an emptie place. So saith the maker of the cōmentaries, rather the heauen wil descend, and the earth ascend, then nature to permit any thing emptie.

Aristotle bringeth in other two reasons, to proue that the heauen is round.

The first reason is, that vnto the firste and noble body, is due the firste and most noble figure or shape. The heauen is the most noble and first bodye, and the round figure is most perfect, therefore vnto the heauen is due the round figure according to reason: for vnto euery one body nature gaue a forme proporcionably vnto his worke. euen as it appeareth in beastes and in plantes.

Therefore the proper worke of heauen is to moue it selfe continually like to a circle. It was conuenient that it should haue a figure or forme apte and meete for such a mouing, and that is round, wherefore this lacketh the corners which doth let the mouing.

Alfragano

Alfragano saith, if the worlde were plaine, some parte of it would be more neere to vs then other some, euen as that part which is ouer our heads, whervpon the starre that is there, should be more nere to vs, then that which is in the East or in the West, then those things which are neerer to vs, doe seeme greater to vs, so the Starre which is in the middest of heauen shall seeme greater to vs, then that which is in the East or in the West, which we see contrary: for the Sunne or another Starre seemeth greater in the East or in the west, then in the middest of heauen, the cause of this is, not because the Sunne or the Starre is greater or lesser, nor that he is farther or neerer: but for some vapours that riseth vp, and putteth themselues betweene our light, and the Sunne or the Starre, and as those vapoures are thicke bodies, they take away the Beames of the Sunne or starre from our sight, in such sorte, that the thing in his owne quantity cannot be comprehended.

As it may be likened to a peece of money cast into cleare water, that because of the glistering of the beames or strekes, it seemeth to be of greater quantitie then it is.

Euen so doth the Sunne or starre, when the vapours are put betweene them and our sight.

The fourth Chapter, of the noblenes of the heauen, and of his colour.

Aristotle saith, that the noblenes of the heauen is vnderstoode in the clearenesse of his shining, in the roundnesse of his fourme, in the vnitie of his equalitie, in the vertue of his mouing, in the height of his scituation, which is very farre from the center of the earth, in the diminishing of his quantity, which doth ouerreach the imagination and measure of reason.

In nature nothing is like to it, neither comparable to it in vertue. The heauen is none of the elements, nor hath their qualities, nor is compounded of them, if it were, it should be corruptible, for all things compounded of the elements, shall be dessolued and corrupted.

The heauen is ingenerable inaugmentable, it cannot receiue strange impressions, it is neither light nor heauie, hotte nor colde, drie nor moiste, formall or royall, but vertuous, for his vertue and influence doth heate, so saith the Philosopher in the first of the Heauen and the Worlde, and so improperlye it may be said, it is not to be broken nor penetrable, and likewise improper, thick, or congealed, improperly it hath his colour bright.

And forasmuch as ỳ colour which seemeth to vs it hath, is to be vnderstood, that our sences many times deceiueth vs, and the sight may sooner deceiue vs, then any other of our sences, for our eyes be of so tender a composition, that any manner of forme sent of any visible thing, we feele greefe thereof.

So saith Alacen in the perspective, the thirtie nine rule.

And Aristode in the Booke of Qualitate Visus, whereby I saye that nothing aboue the Moone can bee seene, but the Sunne or the Starres, which Starres we see by meanes of the light that they receiue of the Sunne.

But as touching the colour of heauen, it is to be noted, that it taketh colour in one of two sortes, one is of it selfe, and so is the second qualitie caused of the first, euen as the white, the blacke, and other colours: in this sorte the celestiall bodies haue no coloures, but in another sort it is taken, that is to say, commonly by all that which the light doth shew, and extendeth it selfe to that which is bright and pearcing, and in that manner the heauen hath his colour, that is to say, shining.

The fifth Chapter, of the tenth heauen, called the first moueable, and of his mouing.

Seeing there hath been declared the number of the heauens, their shapes and qualities, I will speake perticularly of them, and especiallye of that which serueth for our purpose, of the which I say it is manifest to our sight, that the heauens moue, and it is to be vnderstoode, that a mouing is a passing from one place to another, or from one limet to another, this mouing may be in one of these three sortes, by meanes of a circle, or straight way, or from aboue downward, and so contrary.

The first of those three, which is the mouing in circle maner, moueth not place according to all his quantitie, but according to his parts, as it appeareth in a wheele, vnlesse it be all moued from one place to another, that they make it goe round, so they moue all his partes, such is the mouing of the heauen, so that which is now in the East, afterward shalbe in the West, and although the heauen moueth not place according to all the proportion which it hath, yet it is well moued which in it is moued: and this hath commonly beene doubted, if the firste moueable of the heauens were moued by one onely mouer, or by many: and if by many, how many there are, and in what sorte they moue it. Of the which is to be noted, that the heauens in the first moueable are moued of one mouer, and that they are not moued of many, for one only is sufficient, and many would be superfluous: so saith the Philosopher in the firste of his naturall philosophie, that it is better to put one beginning then many, and a fewe rather then an infinite number, therfore it is better to put one onely mouer then many, who maketh this first moueable: there are diuers opinions, one saith, God alone, bringing therfore that which Aristotle saith, that the first mouer ought to be of an infinite strength, and seeing that God is of an infinite strength, and hath created all things of a reasonable strength, it seemeth that God onely is he that moueth the first moueable.

Others there are that proueth that the first mouer is a certaine intellecting which moueth, the which they proue in this manner. If the first mouer were God, it would follow either that the mouing of heauen were done at one instance, or the doings of God be measured with time.

Therefore it cannot be saide that the heauen is moued at one instant, seeing that all Astronomers holdeth and the sight sheweth it, that in foure and twentie houres there is one reuolution accomplished. Nor the second can be, for the said Philosopher in the fourth of the naturall philosophie saith: The euerlasting is not in time, nor his doings are measured with time, but this is it which most commonly is vnderstoode, that an Angell maketh the first mouing, and likewise all the other heauens haue intellective motion, which moueth them in their owne mouinges, and hereby it appeareth how orderly they moue since the time that God made them, vntill the like mouing doe cease when his will shalbe.

Therefore I say that the first moueable, or the first mouing which is of the tenth heauen, according to that as hath beene spoken of, giueth a turne once in foure and twenty houres round about the Worlde, from the East into the West, and with this his mouing he catcheth and carrieth with him all the other inferiour heauens, and maketh them giue a turne to the Worlde in the time that he giueth it, although that their owne mouinges be contrary to this: this is shewed because we see that the Starres, the Sunne, the Moone, and the other planets haue their first originall, and are created in the East, and by little and little they rise vp and ascend, vntill they come to the Meridian, and so with one accord they descend and come to the West, and alwaies they make this mouing in the same foure and twentie houres, as the tenth heauen doth, so that continuallye they obey the mouinges of the first moueable.

And it is to be noted, that forasmuch as it is saide of this forceable mouing or catching which the first moueable doth vnto the other inferiour heauens, it is to be vnderstoode that in the celestiall bodies is no forceable mouing or violence, nor any resistance or contradiction, but all with one conformitie or accord doe follow the first mouing.

And so when it is saide that the first moueable doth catch the other inferiour heauens, it ought to be vnderstoode soundly, as if he should say, the inferiour or lower heauens are moued of the higher by an accedent, euen so as the Mariner moueth the ship mouing her selfe, wherein he saileth, or as the water in a vessell, the vessell being moued, the water also moueth, so it is to be vnderstoode, that the inferiour heauens doe moue themselues by the mouing of the first moueable, so by that aforesaid, it seemeth that alwaies there may be a doubt saying.

A Doubt. How can it be that the tenth heauen mouing it selfe continually

without ceasing from the East to the West, that the other inferiour heauens mouing themselues with him, doe make their owne mouinges contrary, so that in one selfe time there is made by one selfe body different mouings.

A declaration, For the declaration of this, the present example is to be noted, if in the wheele of a Mill were set a Flye or an Ante, although that the wheele doth make his mouing very quicke and hastie, yet the Ante or Flee may be going at their leasure, and make their mouing contrary to that which the wheele doth: as also if the Wheele carrieth them round about, and in a shorte space giueth a turne, yet they make an ende of their mouing at their leisure. so that in this sorte the mouing which the tenth heauen doth make, which is in euery foure and twentie houres, the inferiour heauens although they are moued of him, they make their owne mouings contrary, the which euery one of them by himselfe doth make an end in different times.

The sixth Chapter, of the ninth heauen called Christaline or heauen of water, it is declared how there is a heauen of water, and of what qualitie it is.

THe ninth heauen called the second moueable, which first of all challengeth the mouing from the West into the East for his owne, because of the tenne moueable heauens. This is the first, and that most by leysure maketh his mouing from the West into the East, this is called the Christaline Heauen or heauen of water, of the which is written in Genesis the first chapter, where God saide: Let the Firmament be made in the middest of the waters, so that the waters remaine deuided, some aboue the Firmament, and others beneath, the which Firmament is the eight heauen. In such sorte that of waters which remaine aboue the Firmament is the ninth Heauen. Of this it seemeth there may be a doubt, saying.

A doubt, How can there be waters aboue the Heauen, seeing that naturally water is heauye, and all bodies which are heauie doe naturally descend, neither can it be said that God hath them there, for any miracle, but by a naturall meanes.

A declaration, To this Nicholas de Lyra, answereth in the glose vpon the said article in the first of Genesis, where he saith: that these waters are taken here in a double sence, for those waters which are aboue the firmament, be of a celestiall nature, that is to say, of the like qualitie that the heauens are of, and of their own nature: and those which are vnder the firmament are of elementall nature.

This heauen is called the heauen of waters or christaline heauen, because it hath a pearcing light like to water, and cleere shining like to Christall, of this ninth heauen, or of the tenth we haue no signe, nor there is any in them, nor our sight doth passe the eight heauen where the fixed starres are.

The

The seuenth Chapter, of the eight heauen, which is the firmament or starry heauen, and of the light of the Starres, and of their greatnes.

THe eight heauen, which is the starrie heauen, is called the Firmament, by reason that in it are the fixed starres, in such sort as none by himselfe moueth, but altogether, of these it is to be vnderstoode, that although we see them bright, yet there is none of them that haue any light of themselues, but the Sunne giueth light vnto them all, for he onely hath light and no other bodie. This light God made the first day, as it is written in Genesis the first Chapter: and the text saith, That God saw the light, and it was good. Saint Austine speaketh of the light, that it is a corporall substance, soueraigne and simple, multiplied in vertue, and shining with brightnes without resistance, it is communicable and delightfull, and therefore among all other bodies there is nothing so profitable, so quiet, so vertuous as the light. The light is sprinckled abroad from the heauen to the earth, it is the beautie of all visible creatures, and is the cause wherewithall the other bodies of the worlde be praised, seing that I say the starres haue no light of themselues, more then that which they receiue of the Sunne. So Albertus Magnus writeth in the second of the heauen and the worlde, the first Chapter, where he saith: all the starres of heauen are lightened of the Sunne, as also the Moone, but there is a difference in receiuing of their light, and so they differ in receiuing their vertue, as they differ in the noblenes of nature, in such sorte, as some are most pure and most noble, and these receiuing their light at one instant, it doth penetrate them from the superficie which is oppolite to the Sunne, eueu to the other superficie, so that all the starres remaine cleane and full of light, others also are penetrated with the Sunne, although that by their nature they decline to some colour, but how soeuer it be, the Sunne doth penetrate them at one instant, and filleth them full of light, euen as a candle is lighted with fire: and heere it is to be noted, that in this eight heauen is the Zodiac where the twelue signes are, or the houses of the Sunne. These signes are compounded euery one of a certain number of starres, and besides the signes, there are other 36. images, which are also compounded of stars, so that there are in all 48. and these stares which doe compound these signes and images, are in number 1021. Of these speaketh Alfragano in the third book of the assembling of the starres, that the least of the fixed starres to a notable sight is greater then all the earth. And if all the bodie of the earth were put into the place where the fixed starres are, although it had light by reason of the great distance, it would be so little, that we should not see it, but this authoritie is not to be vnderstoode of the Planets, for all of them be not greater then the earth, nor it is to be vnderstoode of all the fixed starres, therefore it is to be saide of them that are most notable to the sight.

For there are some fired starres so little, that we see them not, there be others also, that although we see them, by reason they are little they are not accounted of the Astronomers, but onely such as are great, and these be not all of one greatnes or quantitie, but of diuers quantities, and therefore they be deuided into fire differences. So Ptholomie hath it in his Almagesto, and the King Don Alonso in his Tables.

The eight Chapter, how it is vnderstoode that the Sunne doth enter into the signes, and wherefore the signes haue the names of beastes.

IN the Chapter which goeth before was saide, that in the eight heauen is the Zodiac where the twelue signes haue their place or houses of the Sun, and of this it seemeth that two things may be doubted.

The first doubt, To the first, seeing that these signes or starres are in the eight heauen, and the Sunne in fourth, how can the Sunne enter into the signes, seeing there is so great distance betweene the Sunne and them.

The second doubt, To the second, if euery one of the signes be compounded of Starres, wherefore doe we say that one signe is called Aries, which is as much to say, a Ram, and another Taurus, which is as much to say a Bull, and likewise of others, seeing that in the heauen there is not any beastes.

The first declaration, To the first, although it be true that the signes be in the eight heauen and the Sunne in the fourth, it is to be vnderstoode that the mouing which the Sunne maketh in all the yeare is, that he moueth himselfe vnder the starres of the signes, and so when we say that the sunne is in such a signe, it is vnderstoode that then he moueth himselfe vnder the starres of that signe, as also any of vs may stand vnder any signe, or vnder the Sunne: and the distance that is from the one to the other doth not let it.

The second declaration, To the second, it is so, that in the heauen are no beastes, but these are so named by reason of the effectes which the Sunne worketh, being in euery one of the signes which doe followe and answere by propertie or likenes to one of those beastes, and by demonstration of such an effect, it compareth it selfe to the likenes of such a beaste, or to another thing that it is likened vnto, as in the Chapter following is declared, that the Sunne entring into euerye one of these signes, doth cause diuers effectes. Therefore it is to be noted, that of these twelue signes, foure of them are moueable, foure fired, foure common: the moueable are Aries, Cancer, Libra, and Capricorne, these signes are called moueable, for ỹ sun entring into euery one of thē, it is said that the disposition of the aire doth varie, and not continue in one estate, and likewise the Sunne entring into Aries, it moueth from Winter into Sommer, and entring into Cancer, it moueth from Summer into Estio, and entring into Libra, it moueth from Estio to Otonno, which is harvest time. And entring into Capricorne, it moueth from Otonno or harueſt

time into Winter. The fixed signes are, Gemini, Virgo, Sagitarius, and Pisces, they are called fixed, for the Sunne entring into any of them, it is saide, that the time and the disposition of the aire doth continue in his owne estate: they which are common, are Taurus, leo, Scorpio, and Aquarius, they are called common signes, for there appertaineth to them some thing of the moueable and of the fixed, and so the common in parte is moueable, and in part is fixed.

The ninth Chapter, what a signe is, and what likenes it hath with that whereunto it is compared, and what day of the yeare the Sunne entreth into euery signe.

I haue saide that ỳ signes of the Zodiac haue names of beasts, by reason that the effects which the Sun doth work by entring into euery one signe, they haue likenesse or property with that beast or with that thing wherof the signe beareth name. And because I thought good to declare this at large, I will shew what thing a signe is, and how many manner of waies it is taken, and the likenesse that euery signe hath, with that wherewith it is compared, and in what day of the yeare according to the common opinion, the Sunne entreth into euery signe.

For the first is to be noted, that a signe according to the saying of Sacrobusto, is a piramide of foure sides, whose seate is that superficie which we call signe, the sharpenesse therof is toward the center, the signes are those starres that the Astronomers were accustomed to contemplate on, looking on their light or brightnes, whereby they knew what weather would come, and many were accustomed to behold them, and therby they foresaw the qualities of the Summer, Winter, and other times of the yeare. For the principall starres in their risings and in their setting, doe shewe the qualities of the times: a signe is also taken by one parte of the Zodiac, the which the Sunne doth passe, after he hath gone thirtie degrees from his mouing. And because the Sunne in one yeare doth passe the Zodiac, which hath three hundreth and threescore degrees, therefore the signes or houses of the Sunne are twelue, so saith Ptholomy in the second Quadri Partiti, that the signes are twelue, answering to the twelue partes of the earth, therefore of these signes.

The first is Aries, and the reason why this signe is first named before the others, is because that some holdeth, that in the first degree of this signe the Sunne made his mouing the first day that he began, and that day he was in the Equinoctiall, and also for because the Sunne entring into this signe making heate, bringeth forth moisture, by the which it is a liuely mouing of generation. This signe is called Aries by similitude, euen as a sheepe is weake in one parte of the body, and is strong in the other, so entring the Sunne into this signe the eleuenth of March, in the first parte is a little hotte, and in the last with greater strength his heate is felte.

The

The 2. ſigne is called Taurus, to vnderſtand, that as the Bull is a ſtrong beaſt, ſo entring the Sunne into this ſigne the eleuenth of Aprill, it heateth with moze ſtrength then befoze.

The third ſigne is Gemini, of this is vnderſtoode, that the Sunne entring into him the eleuenth of May, with his vertue of heating ingendzeth.

The fourth ſigne is Cancer, into the which the Sunne is entred the eleuenth of June, it is marked like a Crabbe.

The fifth ſigne is the figure oz ſhape of a Lion, which is a ſtrong beaſt, collerick and full of anger, ſo that the Sunne entring into this ſigne the fourteenth of July, it bzingeth a ſtrong heate.

The ſixth ſigne is Virgo, by the which is noted, euen as the virgine is barren and doth not engender, ſo the Sunne entring into this ſigne the fourteenth of Auguſt, the earth is barren, and bzingeth not fozth any thing by reaſon of the great heate.

The ſeuenth ſigne is Libra, marked by a paire of ballance of like equalitie, to vnderſtand, that the Sunne being entred into this ſigne the thirteenth of September, the day is equall with the night.

The eight ſigne is marked with a Scorpion, which is a beaſt that with the tung he flattereth, and with the taile he poyſoneth, ſo when the Sunne is entred into this ſigne the fourteenth of October, the firſte parte thereof is temperate, but the laſt is colde.

The ninth ſigne is Sagitarius, which is a beaſt offenciue, ſo that the ſun entring into this ſigne the 13. of Nouember, offendeth with colde and ſnowe.

The tenth is Capricorne, wherein is vnderſtoode, that euen as the Goate from the lower parte goeth vp to that which is high, ſo the Sunne entring into this ſigne the fourteenth of December, from the loweſt parte of our hemiſphere, beginneth to goe to that which is high.

The eleuenth ſigne is Aquarius, marked by a man that ſheddeth water, foz to ſhew, that entring the Sunne into this ſigne the eleuenth of Januarp, he ſendeth to the earth water and moiſture.

The 12. ſigne is Piſces, marked by two fiſhes in the water, which is colde and moiſt, to ſhew that entring the ſunne into this ſigne the 12. of Febzuary, the weather is colde and moiſt. Of the afozeſaid it may be known, the diuerſitie of the effectes that the ſunne maketh in euery ſigne: But it is to be noted, that this doth happen to ſuch as doe dwell from the Equinoctial towards the Nozth oz pole Artick, foz ſuch as inhabit towards the pole Antartick, the ſun being gon fozth of the equinoctial, doth make contrary effects to them, ſo that when we haue ſummer, they haue winter, in ſuch ſozt that the ozder of the ſignes in ỹ zodiac is not confozmable oz agreable to al, foz if vnto vs commeth fozth firſt Aries befoze Taurus, to them commeth fozth firſt Taurus befoze Aries, and in like ſozt of the other ſignes, as in ỹ materiall ſphere is plainly ſhewed.

The

The tenth chapter, of the ſeauen heauens, of the planets and their mouings, and how they haue impreſſion, and cauſe generation and corruption in the inferiour bodies.

SEing that the eight heauen hath been treated of, and of the Starres and ſignes that are in it, it is conuenient to ſpeake of the ſeauen inferiour heauens, which are named by the planets, of the which is to be vnderſtoode, that of the ſeauen heauens, the firſt is Saturne, the ſecond is Iupiter, the third is Mars, the fourth is Sol, the fifth is Venus, the ſixth is Mercurie, and the ſeauenth Luna, more neere vnto vs then any of the reſt: theſe ſeauen planets are called ſtarres, which are moueable not becauſe they erre, but becauſe their mouings be not vniforme nor agreeable, theſe doe moue the elements, and doe corrupt the things that are corruptible, they bring cloudy weather, and raiſeth vp the waues of the ſea, they moue tempeſts, and cauſeth flowers to growe, and the heauens and planets haue naturall vertue to cauſe theſe effects, the works of theſe planets are diuers, according to the variations of the cuntries and regions, and therby their impreſſions are printed in beaſts, birds, and plancts, and in men, they incline more to one then to other: but although they doe ſo incline and moue, they do not conſtraine nor binde by force, but rather as Pholomie ſaith: the wiſe man is Lord ouer the ſtarres, he is wiſe that followeth not ſenſualitie, but reaſon, euery of theſe planets haue a ſphere of his owne, wherein he moueth in circle wiſe: and the ſuperiour circle moueth round about ſo neere to the inferiour, that betweene the one and the other is no ſpace nor any thing emptie, ſo that theſe heauens doe ſhut one with another, and they are nere together in ſuch ſorte, that any thing how little or ſmall ſoeuer it be, cannot put it ſelfe betweene the one and the other, as it appeareth in the elements, that between the one and the other there is no place emptie: ſo that we ſee between the water and the earth, or betwein the aire & the water, or between the fire and the aire remain no place that any thing may be put betweene. More it is to be noted, that although the heauens are ſo ioyned together, and nere one to the other, that this ioyning together doe not let them of their mouing, ſo that they moue very diſtinctly, in different times the one from the other, without any let of their mouing, or ſtanding ſtill one onely point in ſuch ſort, that the tenth heauen maketh his mouing in 24. houres, and ỹ ninth heauen that is neere vnto him, in 49000, yeares, and likewiſe the eight heauen doth make his mouing in 36000. yeares, and another in 7000. and the ſeauenth heauen which is next to him, maketh an end of his mouing in thirty yeares. Theſe are thinges which doe teach vs the greatnes and power of the maiſter & maker of ſuch works, vnto whom the ſaid workes giueth praiſe, ſo did the royal Prophet conſider in the 18. Pſalme, where he ſaith: The heauens do ſhew and manifeſt the glory of the Lord, and in another place, Lord the heauens ſhal confeſſe thy great maruels, from the beginning thou madeſt the earth, and the heauens are the workes of thy hands,

And

And it is to be noted, that euery one of these heauens haue two mouinges, one is the first moueable, which is made from the East into the West, turning againe into the East, as it is declared: the other mouing which is proper to euery one, is made by a circle oblique, contrary to the first, that is to say, from the West into the East: of this is to be noted, that according to the opinion of Frauncis Capuano, it was necessary that in the heauens were two contrary mouings, one in the first moueable, & another in the lower spheres, and this for two reasons.

The first is, because the first mouer doth moueable so swift & with so great haste, that scarcely his mouing can be considered, seeing that in twentie and foure houres he passeth all the space that he doth occupie, which causeth that he carrieth with him all the lower heauens, and the fire, and the measured region of the aire, as it is written in the first of the Metheoros, so that if the eight and ninth sphere and the heauens of the planets did not moue vnto the oppolite parte, with a contrarie mouing, the said first mouing would not onely moue vnto the Celestiall Spheres, and to the fire, but would moue all the aire, water, and earth round about, with his dayly mouing, and there would remaine nothing quiet nor firme.

The second reason is, because the starres with their mouing doe cause influence in the inferiour, and so they make impression as they moue, but if euery one did moue according to their onely mouing, that is to say, from the East into the West, so that if they moued altogether with one vniformitie, they would bring to th one equall and vniforme effect, the which should be an inconuenience: for that onely generation is not sufficient, but it is conuenient that there be corruption, and so it was conuenient that all the spheres should moue in their dayly mouing, round about the earth once in a naturall day, because all of them may communicate with vs their impressions. and likewise that they moue in the second mouing in the Zodiac, comming together, and deuiding themselues one from another, to make that the effectes should be different.

Aristotle saith in the second of generation, that the mouing of the starres in the circle, oblique, that is to say, in the Zodiac, is cause of the diuersitie of effects. And so the Sunne in Summer comming neere vnto vs, causeth generation, and likewise in Otonno or Haruest time, and in the Winter going from vs, causeth corruption.

The eleuenth Chapter, of the region elementall, and how it is deuided into foure elements, and why it is not deuided into any more or lesse.

IN the Chapters before written hath beene declared the order of the heauens, their number and mouings, therefore I will now speake of the element

ments, how they are ordeined and deuided. of the which it is to be vnderstoode, that the elements are foure and no more, by reason, that first of all they haue foure qualities, and it may be saide that they ioyne in sirck inde of waies: let vs see if all sire be possible. One ioyning is hotte and colde, another moiste and drie, the third hotte and dry, the fourth hotte and moiste, the fifth moiste and colde. the sixt colde and drie: the two firste be not possible, because there cannot be two contraries in one subiect, the foure which remaine are possible, in the which the actiue, one with the other ioyneth with the passiue: these foure doe constitute the foure first essentias, which are called elementes, and this is by reason of their first simple bodies, euen as it seemeth in their qualities: that is to say, in the fire, in the aire, in the water, and in the earth: because we see that the fire is hotte and drie, the aire hotte and moist, the water colde and moiste, the earth colde and drie: by the which difference of qualities of the first bodies, they are parted in the same maner. All these elements doe moue by the higher mouing, except the earth which is immoueable. So saith Albertus the great in the first of his Metheors, the fourth Chapter, It is necessary that we say the mouing which we see from the inferiour, that is to say, the mouing of the elements proceede of the superiour, euen as of his own cause, but it must be vnderstoode of the superiour elementes, the which in their continuall mouing they moue in circle maner, onely the earth which is most lowe, remaineth without mouing, not only circuler, neither yet straight.

The twelfth Chapter, how the elements doe compasse about one another, and wherefore the water doth not couer all the earth.

These foure elements that before are spoken of, ought to be vnderstoode, that the one doth compasse about the other in this maner, the earth is in the middest of all, like to a point or center of the World, neere vnto the which is the water, and vpon the water and the earth is the aire, and vpon the aire the fire, and the element of the fire is vpon the aire.

Albertus proueth in the fourth of the Heauen and the World, in his thirtie two Commentarie, where he saith: we see that all fire moueth vpward and is eleuated vpon the aire, therefore as his mouing is not infinite, it is conuenient that it come to one place where it is naturall, and there it is conserued, wherupon it is concluded, that the fire is aboue the aire, it is proued by an example in this sorte.

If there be any that haue not seene the Sea, but seeth how all riuers goe to remaine in one place, as their mouinges be not infinite, it is necessarye to conclude and appoint some place where the waters may ioyn, and this place is the Sea, so it is conuenient to graunt that vpon the aire is a place in the hollow part of the roundnes of the moone, where ỹ fire is gathered together.

Therfore

Therefore I say that these elementes either of them doe compasse inroundnesse equally from euery parte of the earth, sauing the water in that parte of the earth, which is discouered for the breathing & life of all liuing creatures, of this it is to be noted according to the saying of Albertus the great, that the water did couer all the earth, and also he saith in the second of the Metheoros, the third treatie, the second Chapter, we see the order of the elementes are in such sorte, that alwaies the ioyning of the one is the hollownes of the other: and this is by reason his roundnes doth girde him thereunto, and because this is naturall and sometimes it was so, that at sometime the earth was couered with water, and all bodies naturallye haue one proper place, whereby it is conuenient that all be filled, for otherwise there would be some thing superfluous in nature, so it is euident, that the proper place of the waters is the superficie of the earth, for alwaies they moue by that place.

Also when at any time two elementes doe not agree in any qualitie, commonly it is called symbol, wherewithall the one doth ioyne with the other.

Therfore it is necessary that there be some meane that they communicate and ioyne together, and seeing the earth and the aire haue no symboll, it is conuenient that they ioyne together by meanes, which is the water that hath a symboll with both, and so it is shewed, that according to nature all the earth was couered with water: of this may be asked what is the cause why the roundnes of the elements failed more in the water then in the others, it is answered, that God did make nothing in vaine, but alwaies worketh for the best.

Therfore as God by his onely grace and will made man, and all other things, I leaue this parte of the discouery of the earth, that man and beastes might be conserued in their owne likenes.

Of this haue past many questions, this is certaine that God of his omnipotencie made it. And so it is written in Genesis the first chapter, that God saide. Let the waters come together that are aboue the heauen, and let the earth be seene drye.

The thirteenth Chapter, how the earth and the water both elements, make one round bodie.

IT is to be noted, that these two Elements Earth and Water, both together doe make one round body. Of this speaketh Iohn de Sacro busto in the first Chapter of the Sphere, the earth is round, which is shewed by the signes and the other starres, which rise not, nor goe downe equally to all men whersoeuer they be. But first of all they rise to them that be in the East parte, rather then to them that are in the West, and why they appeare to one rather then to the other, the roundnes of the earth is the cause therof: and that to be

true,

true, that the ſtarres are ſeene to ſome rather then to others, it appeareth by the Eclipſe, for one ſelfe Eclipſe of the Moone which we ſee at the firſte houre of the night, they which are in the Eaſt parres do ſee then in the third houre of the night, whereby it ſeemeth that it was firſt night, and the Sunne was firſt ſet to them before it was ſet to vs, the cauſe is, the roundneſſe of the earth, and that the earth is round from the North vnto the South, and ſo contrariwiſe it ſheweth it ſelfe, for vnto thoſe which are towards the North appeareth alwaies ſome ſtarres, which are nere to the pole Artick, and the other ſtarres which are neere to the pole Antartick are neuer ſeene. But if any went from the North towards the South or midday, he might goe ſo farre that the ſtarres which he ſaw firſt might be laide vnder the Horizon that he ſhould not ſee them, and how much more he came towardes the South, ſo much leſſe he ſhould ſee the ſtarres of the North, and then he ſhould ſee the ſtarres of the ſouth, that firſt he could not ſee: as contrariwiſe, it would happen to ſuch as went from the ſouth to the North, and the cauſe of this is the roundnes of the earth: likewiſe if the earth were plaine from the Eaſt to the Weſt, ſo ſoone or equally the ſtars would riſe vnto thoſe in the Eaſt partes, as to thoſe in the Weſt, whereby it ſeemeth falſe by the firſt reaſon.

Item, if the earth were plaine from the North to the ſouth, or by the contrary, the ſtarres that one ſhould ſee ſhould neuer be ſet from him whereſoeuer he ſhould goe, the which is falſe by the ſecond reaſon, for if in any maner of wiſe the earth doe ſeeme plaine vnto the ſight of men, it is for the great quantitie that it containeth in reſpect of our ſighe. And if any man ſhould ſay that the mountaines and vallies doe let the roundnes of the earth, to this is vnderſtoode, that the mountaines haue not any proporcion that ſhould let the earth to be round, and if there be any thing, in that ſorte they be as the nailes of a wheele, that very little or nothing doe let his roundneſſe: but note that in one of two manner of waies a round thing may be ſpoken of, the one is by rule, that is to ſay, when the lines which are ſtraightly carried from the center to the circumference be equall, in this ſorte the earth is not perfectlye round: In another ſorte it is ſaide to be round irreguler, that is, when all partes are not of equall diſtance from the middeſt, ſo is the roundnes of the earth. And ſeeing it hath been declared how that the earth is round, I ſay that the water is likewiſe round, which is proued by the reaſons aforeſaid.

Alſo it is proued, that ſuch as ſaile by the Sea, for to diſcouer the land they alwaies goe vp to the top of the ſhip, which is the higheſt part, and happeneth to ſee the Land from thence, and from no other place, and this is by reaſon of the roundneſſe which the water hath.

The fourteenth chapter, how the earth is ſcituated in the middeſt of the Worlde.

ALfragano saith in the fourth difference, if the earth were not in the middest of the World, it would not be of equall distance from euery parte of the heauen. But Euclides bringeth in the first of the Elements, that it standeth in the middest, and is equall in distance from all partes, and proueth so, for if the earth were not in the middest, it would reach more to the East part, or to the West. And for a similitude, when the Sunne or other Starre were in that parte, it would reach more neere to the earth then if it were in the other parte, and so they would seeme greater: which is false, for we see that all people which are vpon the face of the earth, the starres seemeth to them of one selfe quantitie, in what part of the heauen soeuer they be, be it in the middle heauen, in the East, or in the West. And the cause of this is, by reason the earth is equall of distance from the Starres, it followeth therefore, that it is in the middest of the Firmament.

Item, if the earth by any of his partes were more neere to the heauen in one place then in another, he that were in that part vpon the face of the earth which were neere to the heauen, should not see the halfe heauen.

This is against Ptholomie and all the Philosophers, that doe saye, that whereseuer a man standeth, there riseth alwaies with him sixe signes, and other sixe setteth with him, and the halfe heauen is seen of him, and the other halfe is hid from him: so that equally they are distant from the heauen.

Sacro busto saith, that by the selfesame signe or shewe is proued, that the earth is but a point in respect of the Firmament, for if the earth were of any quantitie in respect of the heauen, it would not happen that the halfe heauen should be seene.

And for the better vnderstanding therof, imagine this: if any plaine superficie were put vpon the center of the earth, the which should deuide the earth into two equall partes, and also the Firmament it selfe. Then the eye of him that were in the Center of the earth, should see the middest of the Firmament, and the selfesame eye standing vpon the face of the earth, should also see the middest of the Firmament: of this is gathered, that the quantitie of the earth is insensible in respect of the Firmament.

The fifteenth Chapter, how the earth is quiet and moueth not.

THat the earth is vnmoueable and quiet, it is proued by two reasons: the first is, that being a whole naturall body, and altogether heauie, it goeth to the place most lowe, which is the center and middest of the firmament, and there it remaineth. So saith the Philosopher in the fourth of the naturall Philosophie, and in the first and fourth of the Heauen and the World.

The second reason is to consider, how that the earth standeth in the middest

deſt, and if it ſhould moue and departe from the middeſt, it would riſe vp, the which would happen to it naturallye or violentlye: not naturally, becauſe his naturall mouing is in the middeſt, and ſo his mouing contrary to the middeſt is not naturall to it, then it ſhould be with violence: but it cannot be with violence, becauſe there is no body to be found, that ſhould doe violence to ſo great a body, in greatnes and waight, where it is to be concluded, that it is alwaies quiet and moueth not.

The ſame proueth Albertus the great, in the ſecond of the Heauen and the Worlde, in the third Treatie and the eight Chapter, where he ſaith: the order of the Starres doe learne the earth to be quiet, and placed in the middeſt, for as the Moone is ordeined to be vnder the Sunne, if the earth were not in the middeſt and fixed in it, it would not happen in the parte of the circle of the ſignes, the Sunne and the Moone to be oppoſite to the head and tayle of the Dragon, and likewiſe the Aſtrolabios and other inſtrumenes of the Aſtronomers ſhould be falſe, and by them would neuer be found the courſes and computations of the Starres, as by the ſaide inſtruments our ſences doe attaine vnto, for alwaies they would happen to be diuers and different, for from the earth the circles of the heauen ſhould not be equally ſeen. All the which we haue proued to be Geometrie and Aſtronomie: it is to be conſidered that God made heauen and earth, and all that therein is, he put the earth fixed in the middeſt, becauſe the Heauen and the Starres ſhould compaſſe it about with their mouing, where the diuine power doth ſuſtaine it in the middeſt, euen as a point. Of this is written, The Lord ſaith, I haue hanged the earth in one knot founded vpon his ſtabilitie.

The ſixteenth Chapter, of the center of the earth, and how it may be ſaid that the earth is the center of the Worlde.

The Center of the earth may be vnderſtoode in three manner of wates. The firſte as touching the greatnes of the center. The ſecond of the waight of the center. And the third of the Maze or aſſemblie of the center: the which aſſembly or Maze is in the middeſt of the firmament. This being had foure things are to be noted The firſt is, that in the land is not one ſelfe center of greatnes and waight, for the earth is deformedly waightie, for that the one parte is couered with water, and the other parte is diſcouered.

The ſecond, that the center of the waight of the earth is not in the middeſt of the Firmament, for if you imagine to deuide the earth into 2. equall parts, then the parte that is couered with water would ſurmount the other. The third is that the Center of the greatnes of the earth, and the center of the firmamẽt are not one, for that the earth is not equally couered wieh water: of the which there followeth, ẏ in the earth we may imagin 3 centers really diſtinct

The first is the center of the greatnes of the earth. The second the center of the waight. The third the middest of the firmament. The fourth the reason that the center or point of the Waze or assembly of the water and earth, is in the middest of the firmament. This is because the like assemblie is a waightie bodie, and without let, and so the center touching his waight is in the middes of the Worlde, for that he is waightie by nature, whereby it may be saide, that the earth is in the middest of the Firmament, for that it is a parte of the Waze, which Waze is in the middest of the Worlde.

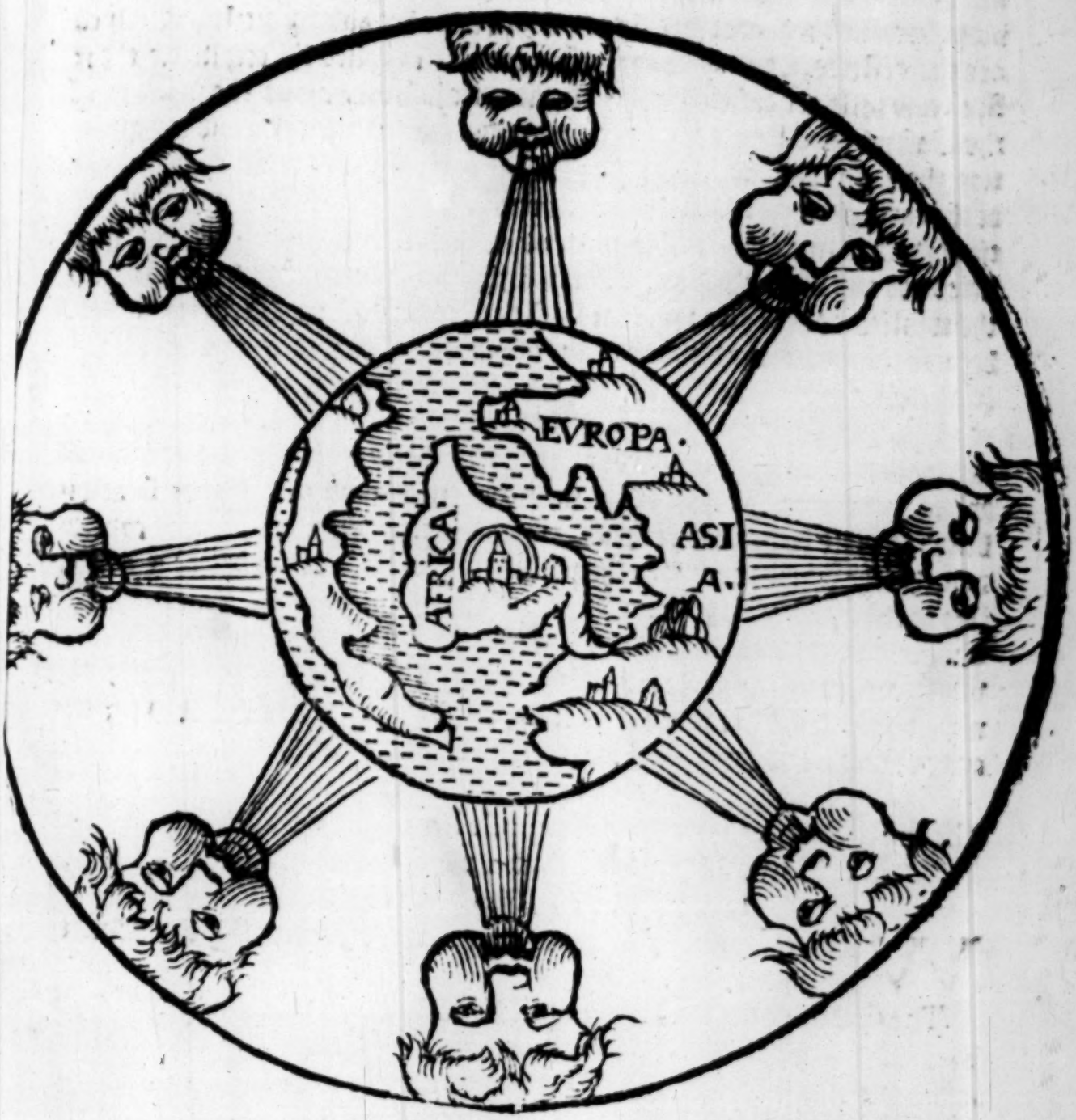
The end of the first Booke.

The second booke, of the Windes, their qualities, and *names, and how one should sayle with them.*

The first Chapter, what thing the winde is, and what qualitie it is of, and how it ingendreth.

For the declaration of the nature of the winde, for the diuersitie of the doubts that are of it, some say it is the ayre, and it moueth, others say that it is water, others that it is a vapour of the earth, and others that it is some great celestiall body or other, that with great force and violence doth push forward the ayre. And this cannot be determined, if his nature be not considered in that which principally it is: the which I say that the winde is a vapour of the earth, that riseth vp, and stretcheth euen to the highest parte of the aire, and strongly thrusteth forth the aire. This vapour is hotte and drye, and by his subtiltye doth pearce the aire, for as the winde is of a subtile vapour in his kinde, and being subtile and light, it is naturall to rise vp, and of the subtiltie of the vapour of the earth he is made, and from thence he descendeth, and in his descending he sheweth that the vapour moueth it selfe vnto a high place, and as he is come to that place is made winde, and so he descendeth blowing. And it is to be vnderstoode, that the vapour riseth not so high as the superiour parte of the aire, which is called Estus, but riseth vp to the cold part, and there as Algazel saith with the colde he wareth thick and descendeth, of the which it seemeth that the vapour whereof the winde is made is not congregated with the inward cold as some say, but with the outward colde of the place by the which as Algazel saith, he is letted that he come not to the superiour part of the aire likewise it is proued, that the vapour is raised vp with heate, and for this if the heate of aire round about do helpe him it heateth the more: for the inner heat is holpen by the outward heat, and so if it were not for the colde of the place, he would neither waxe thicke nor blowe.

The



The ſecond chapter, how the winde moueth not right from aboue down ward, but his mouing is in circle of water and earth.

FVrther for the mouing of the winde, it is to be noted that it moueth not from aboue downward, nor from beneath vpward, but it moueth in circuler or round manner, of the water and the earth: ſo ſaith Albertus the great in the treatie of windes, chap. 12. all windes commonlye moue their blaſt and mouing in circle manner, in ſuch ſorte that they moue not vp vnto that which is high, nor deſcendeth to that which is lowe, but moueth by the round ſuperficiall of the earth. And ſeeing that the ſtarres doe moue in cir-

culer manner, it is conuenient that the winde should moue like a bowe vpon his Horizon. In like manner it is saide, when the signes doe cause windes to blow, because there are three signes which haue hot and dry qualities, which are these, Aries, Leo, and Sagitarius, and this is called the triplicitie of the fire: and these are called Easterly signes, because they moue the windes of the East parte. There are other three signes which haue colde and dry qualities, these are Taurus, Virgo, and Capricorne: and this is called triplicitye of the earth, these signes are called Meridionalles, because they moue the southerly winds continually. There are other three signes which haue their qualities hot and moist, these are Gemini, Libra, and Aquarius, and this is called the triplicitie of the aire: these are called Occidentall or Westerly signes, because they moue the windes of the West parte. There is another fourth triplicitie of the other three Signes, which are Cancer, Scorpio, and Pisces, and this is called triplicitie of the water, for because his property is colde and moist, and these signes doe moue the Northerly windes, and that humour which they haue in his propertie, they cause to abound in the times so attributed in those bodies where they are ingendred. Of the aforesaid it is concluded, that the windes doe moue themselues in roundnes of the water & earth, like to the mouing of the Starres, and not right going vpward nor descending: for the vapour is eleuated with the heat, and is expelled with the cold, which congealeth him, and so it is conuenient that the winde descende not right downe for the heate that riseth vp, but that it be by one side in the circuite of water and earth. And this reason Aristotle giueth.

The third Chapter, wherfore the winde is not alwaies alike, but at some time bloweth hard, and at other times calme, and wherefore it moueth to his opposite.

WIth reason might be asked two doubtes concerning the Winde, which are these.

The first doubt, What is the cause wherefore when the winde beginneth his blast it is not equall, but sometimes hard and other times more calme, and sometimes it ceaseth, and other times it turneth to blowe, so that it bloweth not continually after one sorte.

The second doubt, The second is, wherefore the winde moueth to his opposite, for so we call it when from the East he goeth to the West, and from the North to the South: by the which it is to be said, that the windes mouing of themselues to their opposite, is violent and against nature, or the matter of the windes is maruellous and vnknowne to vs.

The first declaration, The first is to be vnderstoode, that as the matter of the winde which is the vapour of the earth, riseth vp by little and little, maketh a weake and little mouing, but as he is encreased in great quantitie:

so

so with a great force he descendeth, and maketh a strong winde. Also the winde bloweth not continually alike, because the matter which riseth vp is not alwaies equall nor is equally put forward, for the colde is more or lesse, and the vapour not equally congealed: and therefore the winde at one time bloweth hard, and at another time softe.

The second Declaration, The second is to be vnderstoode, that the winde to moue to his opposite is for two causes, the first is as Alpetragio saith, the starres do moue in circle manner, and so the winde doth immitate the circle mouing: the second as Albertus saith, that it is more naturall, because the vapour is ingendred of heate, and is expelled and thrust out of the colde, and the colde is behinde the heate, and therefore is thrust out to his opposite, so that he cannot goe vpright for the colde that is in the aire, nor can descend for the heate that riseth vp, nor can returne backe for the colde which is behinde him: and therefore it is necessary that he moue in circle manner to his opposite, and as much as that which is saide, that nothing moueth forth from the place of his generation it is to be noted: that which is of the nature of aire, moueth it selfe to the place of aire, and the aire hath place in all partes, and the vapour hath the nature of aire as much as appertaineth to his seldome mouing, so that he moueth not forth of his place.

The fourth Chapter, of the whirling of the Winde, and how it is cauled.

IT hath been spoken before, that the mouing the winde maketh, is mouing himselfe to his opposite, by the roundnesse of the water and earth, and not going vpright nor descending, as it hath been proued, and experience in the nauigation doth shew it: and seeing that it is so, it may be asked what is the cause that the winde maketh his remouing right from beneath vpward: this we see that the winde raiseth vp from the ground the dust and the strawe, and carrieth them vpright on high, which is commonly a whirlewinde, and this is as well caused or done in the Sea as in the Land. And in the sea it is made well neere like a right sleeue, and by it the water riseth vpward, as many times it is seene, whereby it seemeth that the winde hath likewise a straight mouing, that is to say, from beneath vpward, as the mouing in roundnes before is declared.

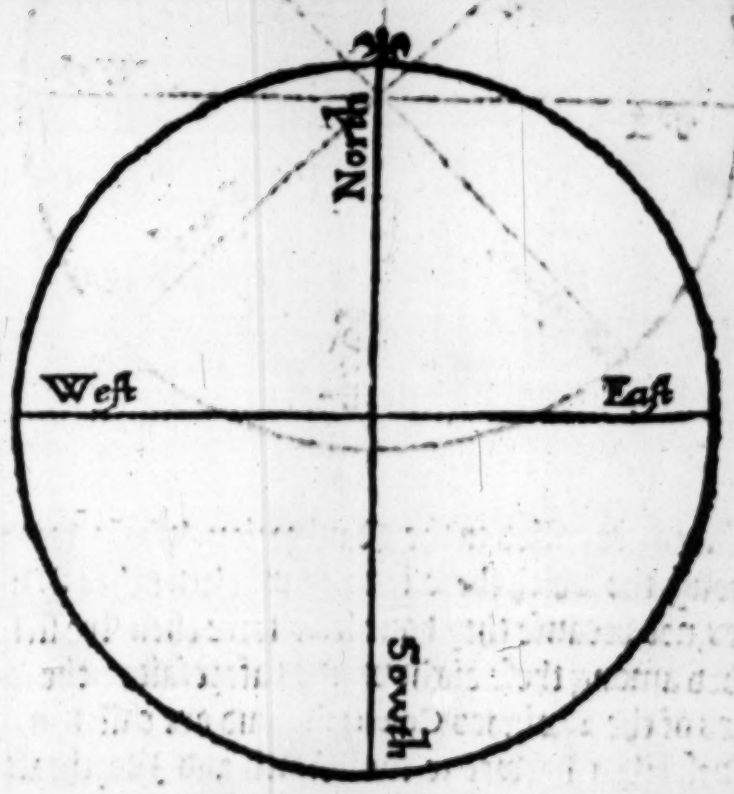
To this is to be noted, that this mouing which the winde maketh is not naturall to it, but accidentall and violent, for because it is done by force, by meeting together in this manner: when one winde commeth from one parte, and another from another parte contrary, and the strength of the one doth meete with that of the other, as euery one of them hath no free running, by the let of the winde he goeth contrary: then he that is strongest thrusteth for-

wardes one other, and so they put themselues into roundnes and make a whirle winde vntill they be deuided: this appeareth by an example in the water when it runneth, that if it finde another body that maketh any resistance, it maketh a whirling, mouing it in roundnesse: euen so the winde as it findeth resistance of another winde, or of some mountaine, or of any like thing that doth resist his course, it cannot goe forward, therefore he maketh that round whirling: and this causeth in the Sea many times that Shippes be sunke downe vnder the water when they finde themselues vnder such a whirlwinde or spout: for the water which the winde raiseth doth ouerwhelme and drown them. Likewise when there are mouings of contrary winds, they cause to rise vp stormes in the sea, which the Saylers many times may know before hand considering and beholding the mouing of the cloudes, if they be contrarye and different to the winde that is beneath: for when it is so, it is a token that contrarye windes doe runne abroade, of the which continuallye the superiour doth ouercome, because he is of more strength and swiftnesse then the inferiour.

The fifth Chapter, of the windes of the Cardes of Nauigation, of their number, and names.

AND seeing there hath beene treated of the windes what thinges they are, and how they are ingendred and moue, in this I will speake of the windes that are marked in the Cardes of Nauigation, their number, and how they haue their names according to the vse of the saylers. Of the which it is to be vnderstoode, that the windes of the Cardes which we call courses, doe shew forth 32. names of windes, which are practised in the Nauigation, and no more nor lesse: and the reason wherefore this number is giuen, is because the roundnesse of the Worlde is imagined to be deuided into 32. parts, and in euery one of these is assigned one winde, and is giuen to him a whole name, or halfe, or a quarter, according to the parte where it seemeth to vs that he commeth, as hereafter shalbe declared. And to vnderstand this is to be noted, that this roundnesse of the Worlde hath 4. principall regions, these 4. partes are named and knowne by 4. windes, which are East, West, North, and South. The East is also called Solano, it groweth vnder the Equinoctiall line: it is also called Leuante, because the Sunne riseth there, and beginneth to appeare in the morning: this winde is called in the Nauigation East. The second principall winde riseth of the Occident, vnder the Equinoctiall line, it is called Poniente, because the Sunne setteth there, or hideth himselfe in the Euening. It is also called Fauonio, and in the Nauigation it is called West. The third principall winde is called Cierco, and groweth vnder the Pole Artick, he is also called Aquilonal, and Septentrional, Aquilonal

lonal because hee groweth in the parte of Aquilon: Septentrional by the 7. Starres of the Vrſa minor: this winde in the nauigation is called North. The fourth winde is called Meridional, he commeth forth vnder the Pole Antartick, he is called Meridional, for when he is come to the Sonne there he maketh vnto vs the mideſt of the day. And in the Nauigation this winde is called South, theſe windes are marked in this maner.



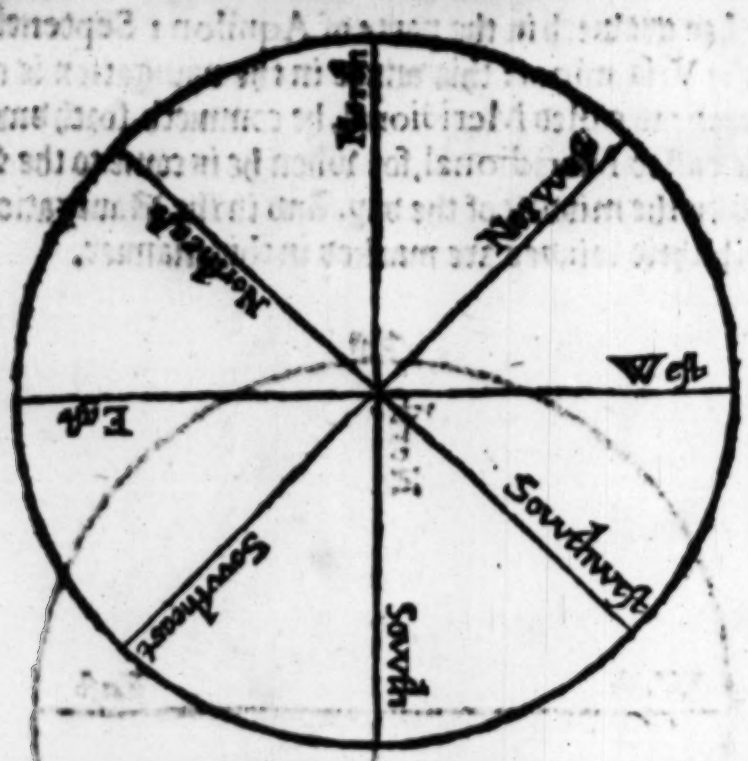
Theſe foure windes haue other foure Colaterales, and are compounded of them, taking a name of halfe the name of euery one in this manner.

The firſt is marked betweene the North and the Eaſt, and taketh name of both, and therefore is called Northeaſt.

The ſecond is betweene the Eaſt and the South, and is called Southeaſt.

The third is betweene the South and the Weſt, and is called Southweſt.

The fourth is betweene the Weſt and the North, and is called Northweſt, and is marked in this manner following.



These 8. windes are called in the Nauigation, whole windes or principalles, among the which there is to be marked other 8. which are called halfe windes, not because they haue lesse force then the first, but because they are described among these eight windes aforesaide, the which also doe take their names of the 2. windes Collaterales, and are called in this manner.

The first is described betweene the North and Northeast, and taking name of both of them is called North Northeast.

The second is called East Northeast, because he standeth betweene the East and the Northeast.

The third is East Southeast, because he is betweene the East South east.

The fourth is South Southeast, because he is betweene the South and the Southeast.

The fifth is South Southwest, because he is betweene the South and the Southwest.

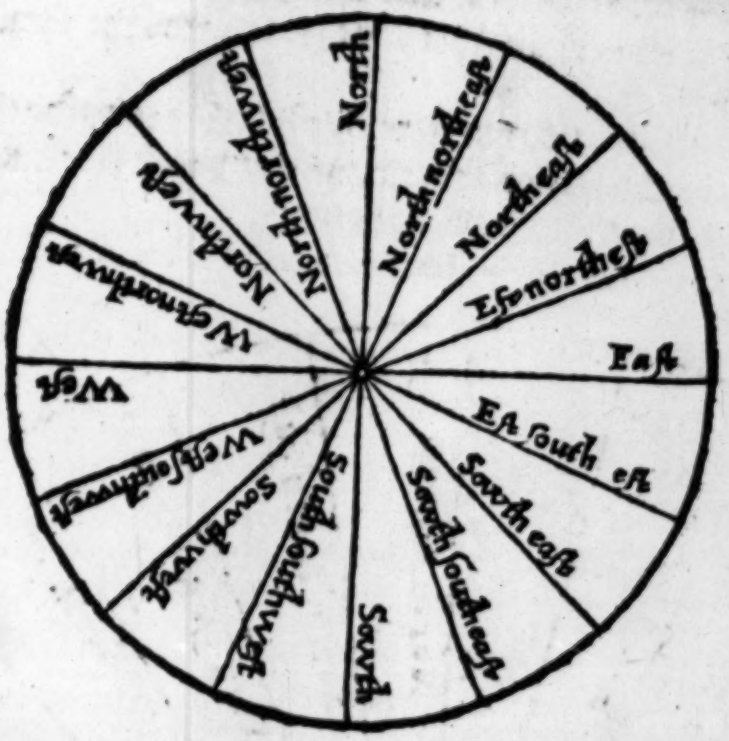
The sixt is West Southwest, because he is betweene the West and the Southwest.

The seauenth is West Northwest, because it is betweene the West and the Northwest.

The eight North Northwest, because it is betweene the North and the Northwest.

And they are ordeined in this manner following.

Among



AMong the 16. courſes of windes and halfe windes, are marked other 16. which are named quarters, and they are put in this manner, euery one of the eight principal windes hath two quarters gathered forth of them, and euery one of them both take the name of the windes neereſt to him, in this manner.

The North hath two quarters, which is by the part of the Northeaſt, and is called North and by eaſt, and that which is by the parte of the Northweſt, is called North and by weſt.

The Northeaſt hath other two, and that which ſtandeth towardes the North, is called Northeaſt and by north, and that which ſtandeth towards the Eaſt is called Northeaſt and by eaſt.

The Eaſt hath other two, that which is towardes the parte of the Northeaſt is called Eaſt and by north, and that which is towards the parte of the South, is called Eaſt and by ſouth.

The Southeaſt hath other two quarters, that which is towards the Eaſt parte is called Southeaſt and by eaſt, and that which is towards the South parte Southeaſt and by ſouth.

The South hath two quarters, that which is towardes the Eaſt is called South and by eaſt, and that which is towards the Weſt is called ſouth and by weſt.

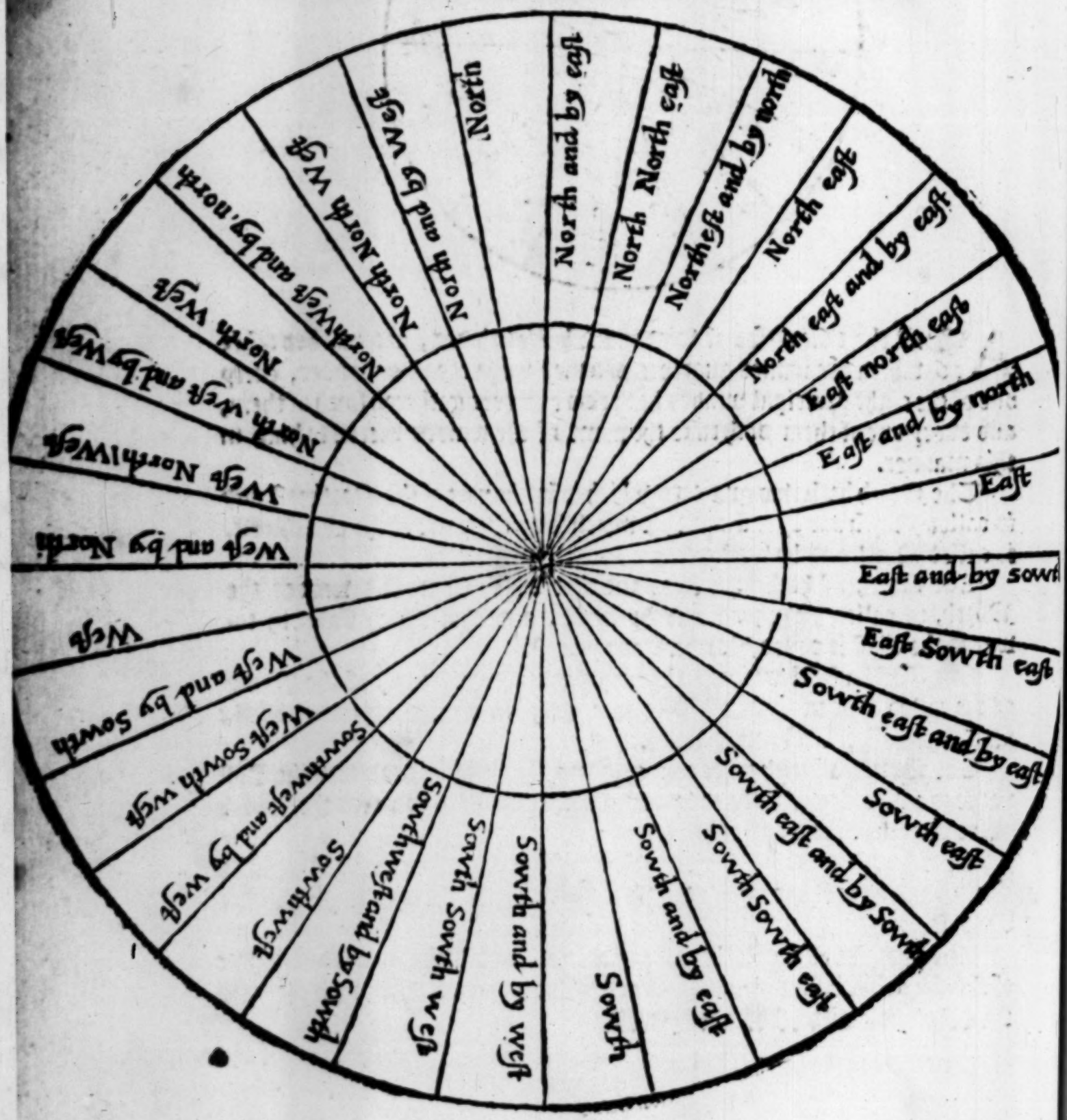
The Southweſt hath other two quarters, that which is towards the parte of the South, is called Southweſt and by ſouth, and that which is towards the Weſt, is called Weſt and by weſt.

The

The West hath two quarters, that which is towards the Southwest is called West and by South, and that which is towards the Northwest is called West and by north.

The Northwest hath two quarters, that which is towards the part of the West is called Northwest and by west, and that which is towards the parte of the North, is called Northwest and by north.

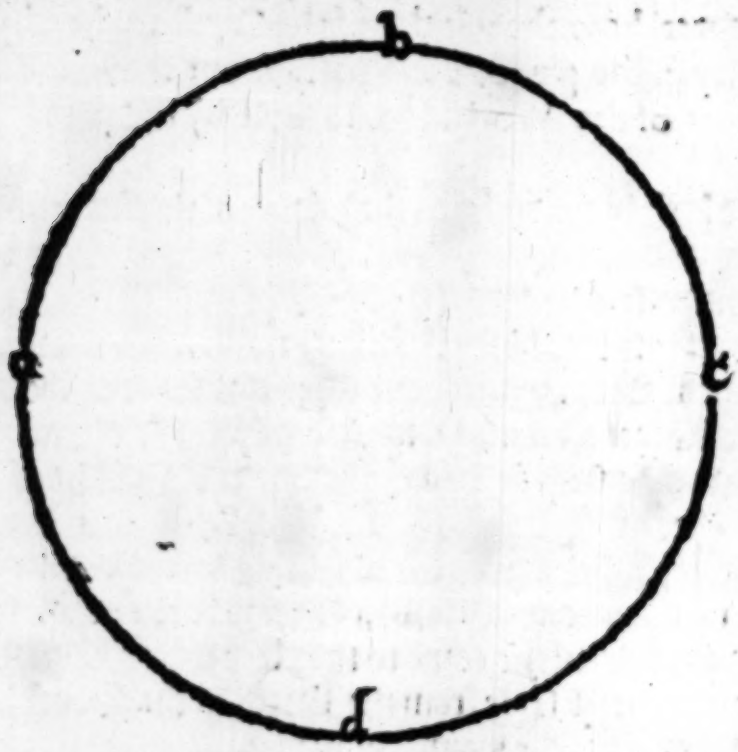
The 32. windes in the Compasse are ordeined in this manner following.



The sixt Chapter, how the windes of the Cardes whereby the Saylers doe sayle, doe girde or compasse about the roundnesse of the Worlde, for to sayle by them.

SEing there hath beene declared the windes of the Cardes of Navigation, their names and differences, I will speak in what manner and order these windes doe compasse about the roundnesse of the Worlde, to know how to sayle by them: of this is to be noted, that this round body of water and earth, hath in roundnesse three hundreth and threescore degrees, therefore he that is in any parte or place and would sayle towards the North, all inconvenience being taken away, he shall saile with the winde at South and no other. It is to be understoode sayling before the winde, although that he not having the winde at South, but some other winde sayling by the bowling, may goe rising by other courses, making boords, one boord unto one winde, and another boord unto another, untill he come to the place where he pretendeth to goe. Likewise he that will sayle from the North to the South, must be with a Northerly winde, or in the manner aforesaid.

The navigation of the East or West is in this maner: a Ship departeth from the Iland of Saint Thomas, or as they call it Saint Thome, which is under the Equinoctiall, and would goe round about the Worlde, if in any case that it might be sayled: this Ship if he should saile toward the East, her way should be in this manner: from the said Iland or place where she departed she shall saile with West 180. degrees, and from thence she will returne to the place from whence she departed, by the same course that she went, she shall returne with the East that same waye, but if she go forward on her way, you shall understand, then all the roundnes will serue you, the West wherewith you departed, untill you come to the point where you came forth, in such forte that in a place where a man is a circle being imagined, which girdeth the Worlde, all this circle is sayled with one winde, but if from the halfe circle, or before or after he will returne by the way that he went, he shall returne with the winde contrary, for it is to be understoode, that from the place that a man departeth untill the halfe circle be ended, he goeth departing from the place from whence he came, and the other halfe he returneth towardes it againe, as the figure following sheweth it.



I say that one departeth from A. to goe toward C. and goeth by B. in A. which is the place from whence he departeth, the winde beginneth, and being come to C. which is his opposite, if he returne from thence to goe to the same B. the winde which is contrary will serue him: but if he goe sayling from C. to D. and from D. to A. you shall understand that with the winde he began to saile by he shall goe all the roundnesse, untill he returne where he came forth. The same accompt shall be made if you begin to saile towardes the West, and that which hath been said of the nauigation by the Equinoctiall, the same must be kept by any manner of circle whatsoeuer.

Also it is to be noted, that onely from the East and West there are circles or courses greater and lesser: the greater circle palleth by the Center, and the lesser palleth not by the Center: but all circles greater or lesser haue three hundreth and sixtie degrees of length, but in the leages that euery degree hath there is difference of more and lesse, euen as the circle standeth neere to the Equinoctiall, or to the poles. But the windes which must serue the turne ought to be of the greatest circles, and none of them of the lesser circles: the nauigation by the other windes is in this sorte.

If one sayling towards the Northeast gaue a turne about the World, going alwaies by the same course, he shall returne by the Southwest from the place where he departed: and the same will be done by the contrary: and in the rest let the account be kept as before hath beene declared. The same doe I say by the Nauigation towards the Southeast, that he shall returne by

the

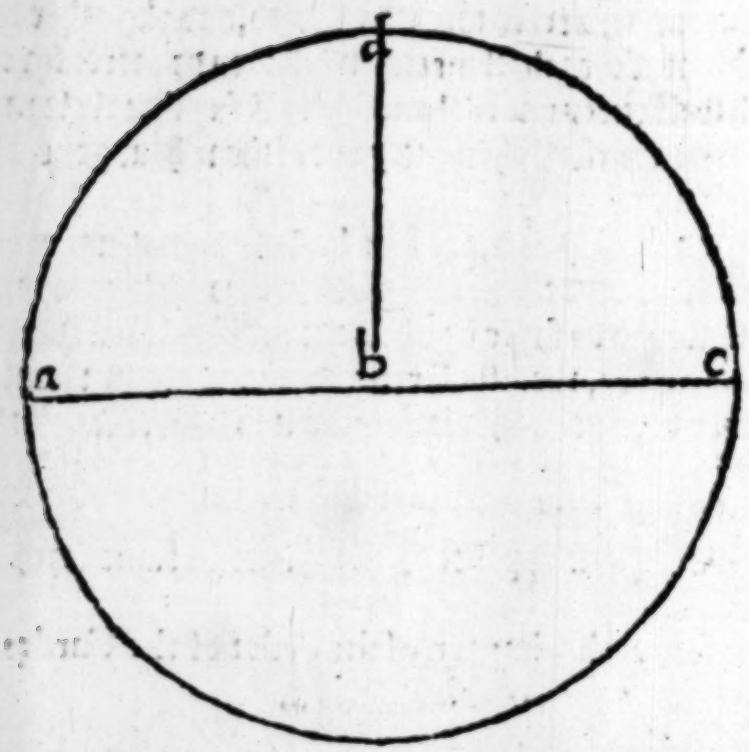
the Northwest. And for an example of this, let it be asked: if two Ships be in one Porte, and one departeth towards North, and the other towardes the South, these Ships if they shall meete, and if they do meete for to goe equall way, how much shall every one of them sayle? I say that these may meet, and that sayling by these courses, when every one of them haue gone 180. degrees, they shall be together.

And in like manner this account is to be kept departing by other courses: and so it is to be vnderstoode, that whensoeuer two Ships or more doe goe forth of one Porte, and do sayle by different courses, when every one of them haue gone 180. degrees, they shall returne and ioyne in the place opposite, from whence they departed: this is because it is saide, that all the windes of the nauigation be of the greater circles, for all of them do passe by the center and so every one going the halfe circle, which is the said 180. degrees, shall finde himselfe in the point oppolite from whence he came forth.

The seauenth Chapter, of the order of the Cardes of Nauigation.

AMong the Instruments which are necessary for the Nauigation, one is the Carde, for without it good nauigation cannot be made, seeing that in it the Pylot or Sayler doth see the place where he is, and the place whether he pretendeth to goe, and seeth the height of degrees that every place hath, so that he knoweth if he shall goe forth right, or if he shall goe rising or descending, he seeth also what winde or windes will serue him in his course, and where he shall leaue one and take another, he also seeth the distance of the way which he shall goe, how many leages it hath, and so he ordeineth in all thinges that which is best and conuenient for him. But it seemeth that with reason there may be had a doubt in the Cardes, wherewith the nauigation is made, and say that they be not certaine nor true for this cause following.

A Doubt, This being proued that the World is a round body, and not onely the heauens, but also euery one of the elements, so that the water whereby we sayle is round, and the winde wherewith it is sayled moueth it selfe in roundnes, and this being so, we see that the Cardes of Nauuigation be not made round but plaine. Therefore from the round to the plaine is great difference, as appeareth by this present figure following.



If two Ships should departe from A. vnto C. and the one of them went by B. and the other by D. so great difference will be of the way that the one maketh to the other, by how much the distance is from the B vnto the D. and seeing that the way which by the Sea is sailed is from the A. vnto C. by D. because the water is round, and the Cardes doth not shew it to be so, but it sheweth it in plaine manner, which is from A. vnto C. by B. whereby it seemeth that the way which the Ship maketh, is halfe more then that which the Carde sheweth: seeing the Ship goeth in it in circle manner, and the Card sheweth it by diameter, and the diameter hath but onely the thirde parte and one seauenth parte of the circumference.

Likewise the aforesaide seemeth to be so, because the round bodye is greater then all other bodies, and as the Worlde is a rounde bodye, there is no other figure so great, that may be compared to it, and so the Carde which is made in plaine, cannot be equall with the round. Also the courses of the Nauigation as they are put in the Cardes in euery hundreth leages, they departe one from the other twentie leages, in such sorte that from the place where the Ship doth departe vnto the rc. degrees, which doth amount to 1575. leagues. In these Leagues they departe one Ship from another, or one course from another 315. leages.

And there are thirtie two courses, the Worlde, that is to say the earth and the water should haue in roundnesse ten thousand and fourescore leages: this is falle, because this roundnesse hath three hundreth and sixtie degrees,

of

of 17. leages and a halfe euery degree, which doth amount to 6300. leages and no moze. Of all the foresaid, it seemeth that the Cardes of Nauigation because they are made in plaine, should be false and vnperfect.

A Declaration, To this is to be noted, that the Cardes of Nauigation are true and altogether perfect, and the arte wherewith they are made and ordeined, doth containe all certaintie. And answering to the first is, that the nauigation which the Ship doth make in roundnesse, and the Carde doth shewe in plaine, is to be vnderstoode that the same quantitie or distance of way that euery parte hath in his roundnesse, the selfesame is reconed and giuen in plaine, as well in the land, as in the water, by marking in the leages and degrees the distance that euery thing hath in roundnesse, without taking from it any thing. And this may well be done, for although that one body be round, there may be giuen to it the selfe same proportion and greatnes in plaine, as Ptholomie setteth it forth in the plaine Sphere. And Iordan in the treatie which he made of the same matter. This seemeth to be by an example in an Apple, that although it be round, the length and bredth that his roundnesse hath, may be put in plaine forme: euen so in the Cardes of nauigation, although in their figure or shape they be not round, yet in the accounting of the way they giue and holde in equalitie with the round, and the round body to be greater then another body. It is to be vnderstoode, that those bodies being equall in circumference, for not being equall, another figure may well be greater then the round: and forasmuch as I say of the courses of the cardes, it is likewise to be vnderstoode, that these be ordeined in Geometrie, and because it is so singuler among the Mathematicals, they cannot be falle, as those Authours which I haue spoken of doe shew. And if by a pointe of the Carde there are found moze leages in the courses then the Worlde hath, this is not hurtfull to the Carde, for this arte and shew of the courses is not only for this number of fiue thousand and three hundreth Leages which the Worlde hath: but for any manner of number, so that although the Worlde had a hundred thousand leages, or had a thousand, the selfesame would serue those courses in one number as in another: as it appeareth, that such as saile one hundreth leages, doe goe in their way as well as those which goe vnto the East India, which saile fiue thousand. And as Magalanes sailed, and such as went with him in the yeere 1521. when the straight was discouered, which of Magalanes is named, that then sayling from Spaine, they gaue a turne about the Worlde: of that as is saide, it appeareth plainelye, that the Cardes of Nauigation are so welordained, that their agreement and perfection is a thing marueilous, seeing a thing so great as the Earth and Sea is, being marked in so little roome as a Carde is, and doe so much agree, that it doth not misse one iotte to sayle the whole Worlde thereby.

The

The eight Chapter, of the account which the Pylot ought to haue in his way when he sayleth with a winde different to his course.

SEeing there hath beene declared the order which ought to be vsed if the roundnesse of the World were sailed, in this I will speak of shorter voyages or waies, and such as are more commonly sayled by Sea from one place to another, and how the Pylots and Saylers should know how to keepe a good account, and giue reason of their Nauigations, whether soeuer they goe, for the which I say whensoeuer the Pylot will saile, he ought principally to looke vpon three thinges.

First of all, the place where he is, and the place whither he mindeth to go, and to know the distance that is from the one place to the other.

The second, in what height of degrees he findeth himselfe, and in what height the place is which he mindeth to goe vnto.

The third is, to know the winde or the windes that shall serue him in his Nauigation, all the which he may see and know in his Carde.

And this being knowne, let him looke if he haue a winde that is conuenient for his nauigation, and hauing it, let him proceede vpon his voyage as weather and time will permit him. And it is to be noted, that many times it happeneth, that for the nauigation that should be made, the winde serueth not according to the course which the Ship should goe, and therefore it is sayled with another winde, which is different.

Likewise it happeneth, that as a Ship goeth sayling there commeth such weather, that causeth her to goe forth of her right way, and take her course vp another, by the which how much more she goeth, so much the land that they goe to seeke changeth it selfe into different courses of the Compasse. This is because the Ship goeth not her right course to the place whither she pretendeth to goe: so that the selfesame place varieth or changeth it selfe from one course into another, and likewise sometimes it waxeth neere, and other times farre of.

And when it is so that the Pylot sayleth with a winde different to that which is conuenient for his course, and sayling would know in what point or course the land whither he mindeth to goe lieth from him, and how many leages he hath from him to it, in the figures following he shall finde it: the which shall profite him to know the certaine place where he is, and therby he shall know how to choose the true course (when weather serueth him) for to returne to the certaine place whether he mindeth to goe, which is to be vnderstoode in this manner.

I say that you will sayle to a land, which being seene in your Carde, and the

the place marked where you are: you shall finde that it is from you towards the North or South, or any other course, and so sayling towardes one place, you runne towards another, and put the case that the land whether you pretend to goe be from you towards the North, so that you should sayle with the winde at South, and because this winde bloweth not, you sayle with another winde: therefore if the Nauigation be by the first course more neere to the winde it selfe, in the first figure you shall finde marked this first course, and neere to it the leagues which you shall goe for to get the land, whither you pretend to goe towards all the courses of the Compasse, as also how many leagues the Land is of from you, and in the manor that the Nauigation is declared by this course, so all others are declared.

And when in sayling you haue not the proper winde which should serue, marke by the winde which you haue, how many points it is off from the proper winde wherewith you should sayle, and seeke it in one of the figures that is heere put, which shalbe one of thē marked with the crosse, and neere to the figure where the like winde is, you shall finde three accounts, these accounts serue in this manner.

In the first account you shall finde how many leagues you shall goe by the course where you sayle.

In the second account is the course where you haue the land whither you pretend to goe, (I will say) that hauing gone those leagues which there are declared, you shall come vnto the land which you seeke after, by the course that is there marked: the which you shall know what course it is by the number that he hath, seeking the same number in the figure that is next to it.

In the third account you shall finde how many leagues you are distant of the same land whither you goe, so that hauing gone the leagues of the first account, you shall haue the land whether you goe at the course which standeth in the second, and you shall be from the same land the leages that are marked in the third account.

This being knowne, three thinges are to be noted.

The first, because heere cannot be put any rule for the number of the leagues that are from the place where you are, vnto the place where you pretende to goe: because at one time there will be more distance then at another time.

Therefore this account is taken out for the number of a hundreth leages, I will say that the place where you are vnto the place whither you will goe, is a hundreth leagues of way.

And it is to be noted, that although this account doe serue for this number of a hundreth leagues, it serueth likewise for any other number of leages that the way hath, in this manner. If the way be of two hundreth leagues, you

shall goe it twise as much as the numbers of the first account doe shew: and then you shall haue the land whither you goe in the course which is marked in the second account, and you shall be from the saide land twise as many leagues of them which are accounted in the third account: and if the way be of three hundreth leagues, you must goe thrise as much as the numbers of the first account shewe, so that of euery hundreth leagues which is increased of the way, you shall giue as much more number of that which is in the first and third account, and then you shall haue the land at the same courses or pointes which are marked in the second account, and if in the way be fifties, or more or lesse, you shal giue a halfe, a third, a fourth, or a fifth, according as the number is.

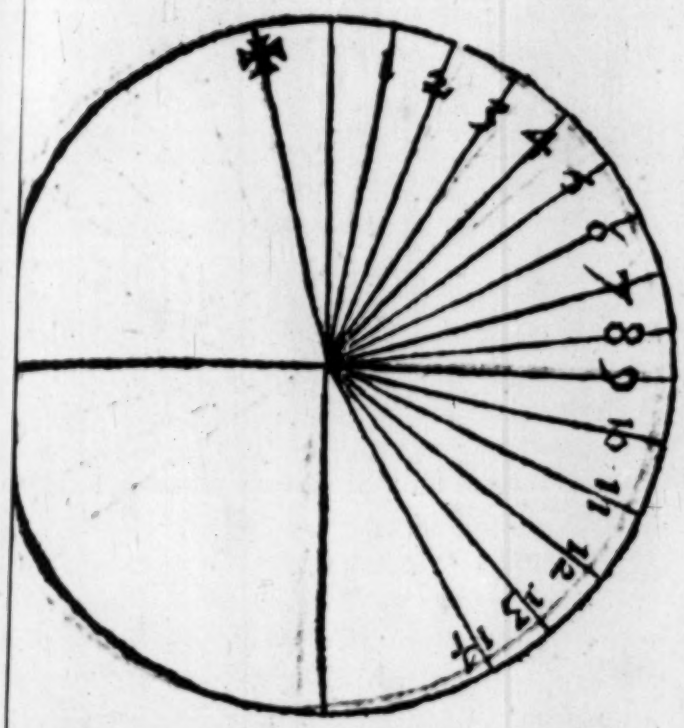
The second is, that in the figures which are put heere, the nauigation goeth marked by the windes of the one part of the Compasse, and by the other parte of the course where you shall finde the land.

This is to be noted, that the same account is when you shall sayle by the parte where the courses goe, and so it serueth for all partes.

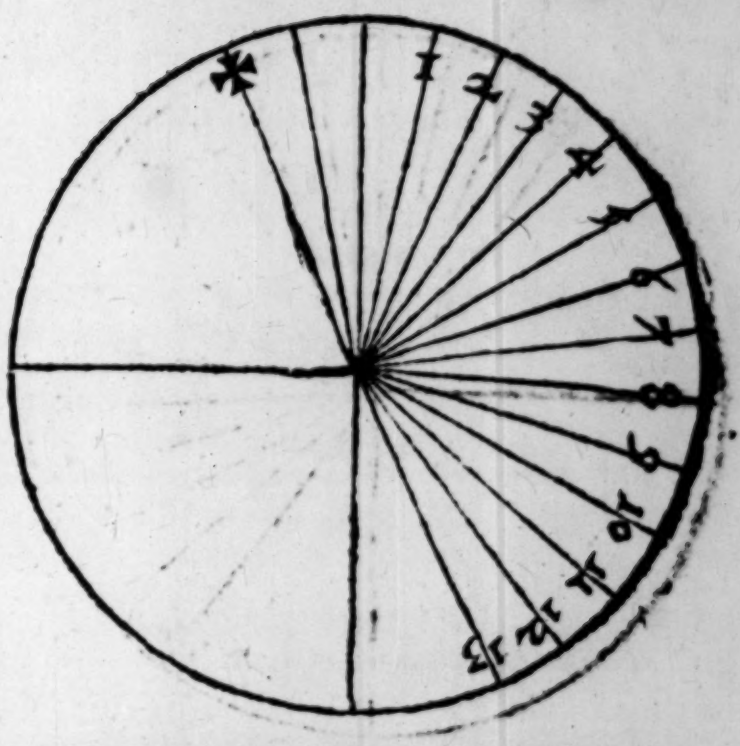
The third is, that towardes the winde that these figures doe shew forthright, shall be giuen the name of the proper winde wherewith you should sayle.

When

When you shall sayle by the firſte Courſe.



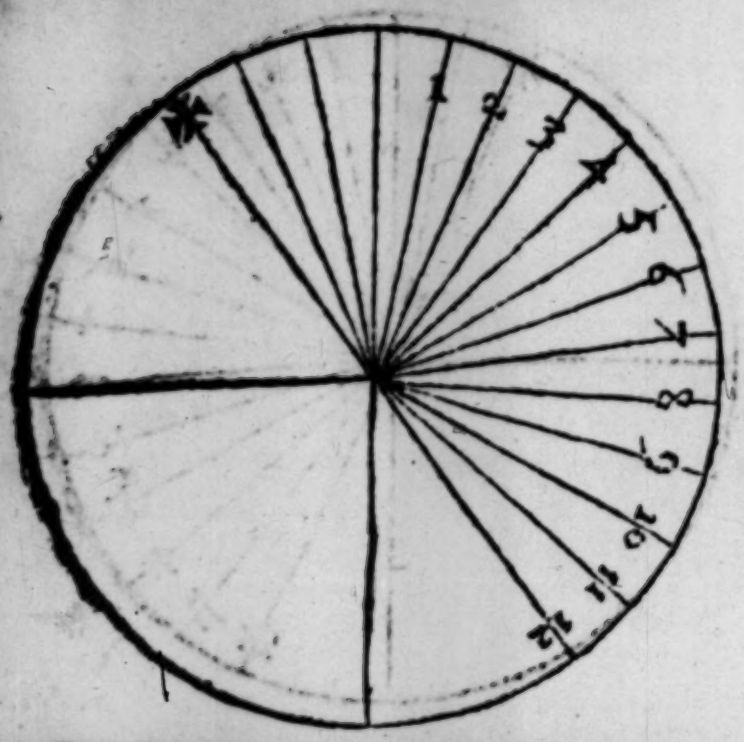
When you shall sayle by the second Courſe.



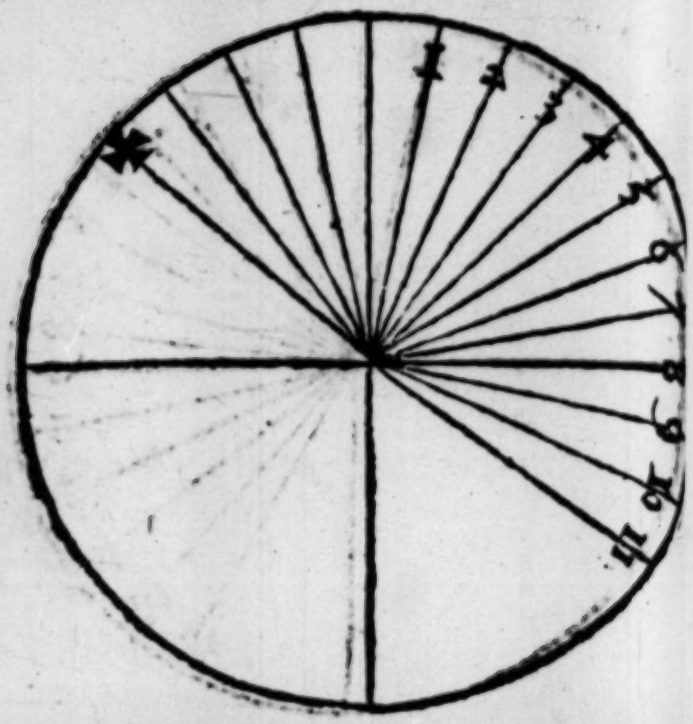
Leagues of the way.	Courſes.	Leagues of diſtance.
l	1	l
lx vii	2	xl
lxx vi	3	xx viii
lxxx	4	xx b
xc	5	xx ii
xc iiii	6	xx
xc viii	7	xx
c	8	xc ii
c	9	lxx b
c x	10	lxx vi
c xb	11	xx vi
c xx	12	xl
c xl	13	l
c lxxx b	14	c

Leagues of the way	Courſes.	Leagues of diſtance.
xxx	1	lxvii
l iii	2	l l
lxx	3	xl ii
lxx ij	4	lx ix
lxx	5	xl
xcb	6	xxx
c	7	xl
c iii	8	xl
c x b	9	xl ij
c xxx	10	lx
c xl iii	11	lxx
c lxxx	12	c
cc lxxx ii	13	cc

When you shall sayle by the third Course.



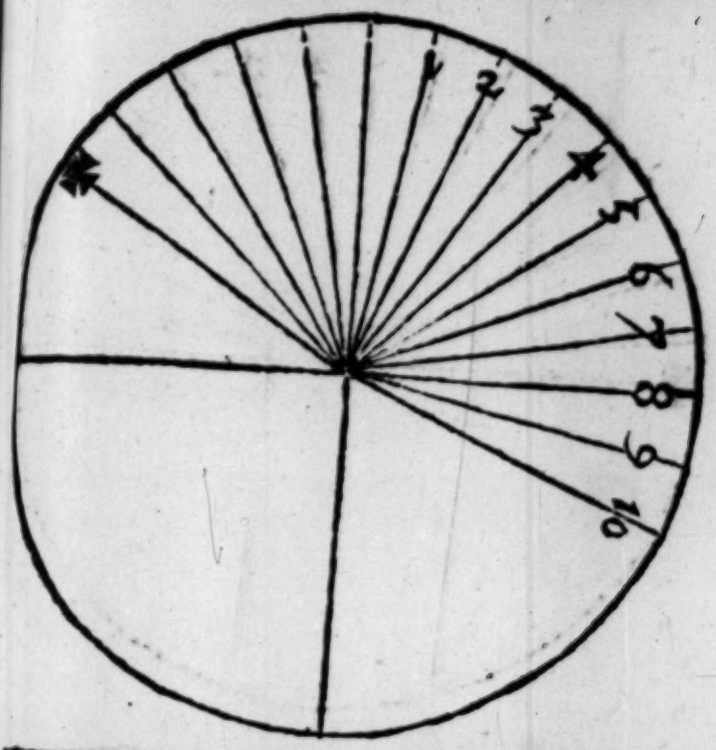
When you shall sayle by the fourth Course.



Leagues of the way.	Courses.	Leagues of distance.
xx v	1	lxxx
xl b	2	lxx
lx	3	lx
lxx	4	l viii
lxxx i	5	l viii
xc	6	lx
c	7	lx
c x viii	8	lx b
c lxx b	9	lxxx
c lx b	10	c
cc x b	11	c xl b
ccc lx	12	cc xc

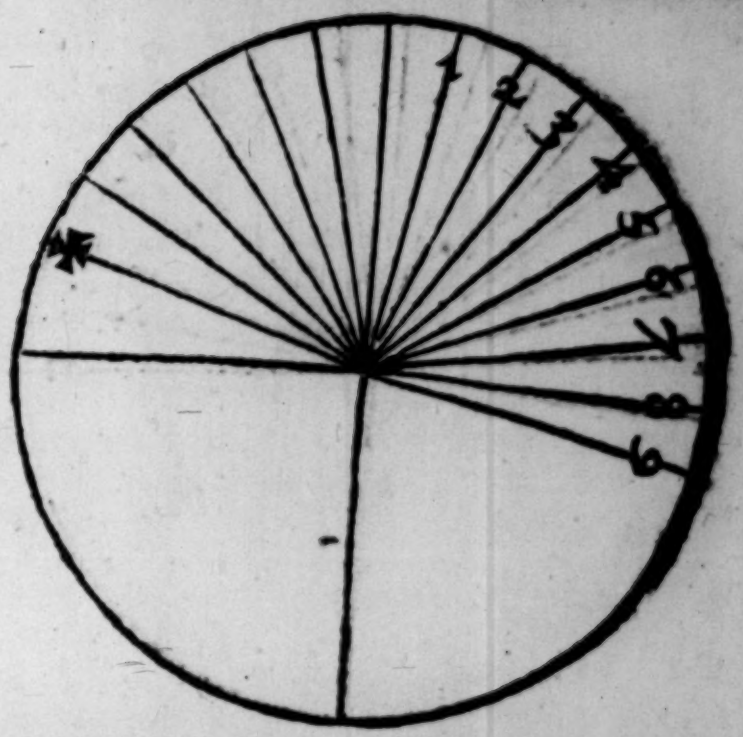
Leagues of the way	Courses.	Leagues of distance.
xx	1	lxxx b
xl	2	lxx v
l viii	3	lxx
lxx	4	lxx
xc	5	lxx
c	6	lxx b
c x	7	lxxx
c xl	8	c
c lxx b	9	c b
cc xxx b	10	c lxxx
ccc lxxx	11	ccc x

When you shall sayle by the fifth Course.



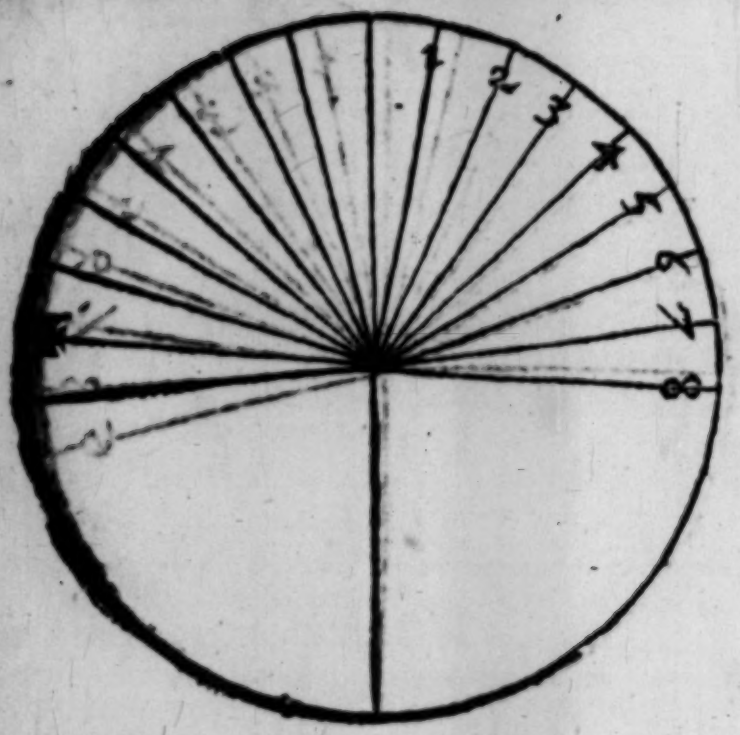
Leagues of the way.	Courses.	Leagues of distance.
xc	1	xc
xl	2	lxxx
l v	3	lxxx
lxx	4	lxxx
xc	5	xc
c x	6	c
c xxx v	7	c x v
c lxxx	8	c xl v
cc x	9	cc xx v
ccc lx	10	cccc xx v

When you shall sayle by the first Course.

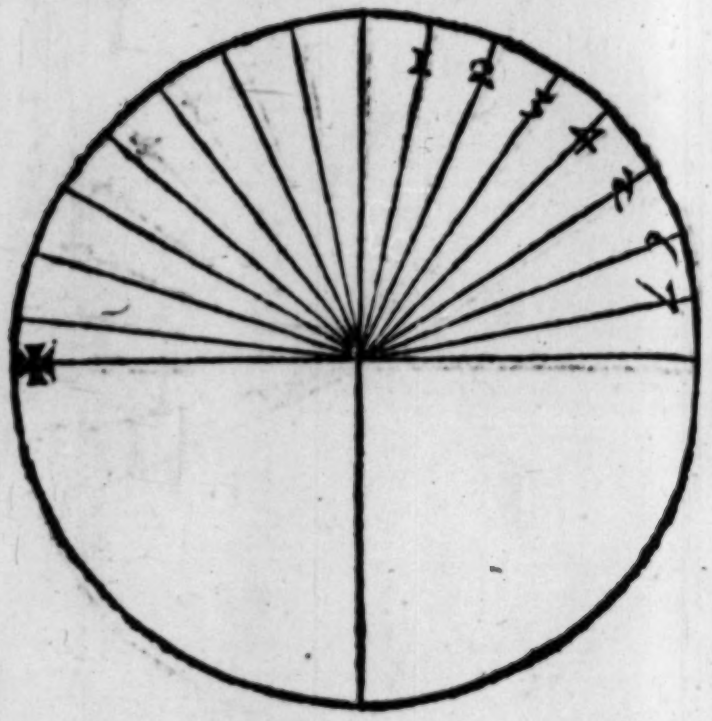


Leagues of the way	Courses.	Leagues of distance.
xx	1	xc
xl	2	xc
l v	3	xc
lxx v	4	c
c	5	c x
c xc v	6	c xx v
c lxx	7	c lx
cc l	8	cc xx
v x	9	cccc lxxx v

When you ſhall ſayle by the ſeuenth Courſe.



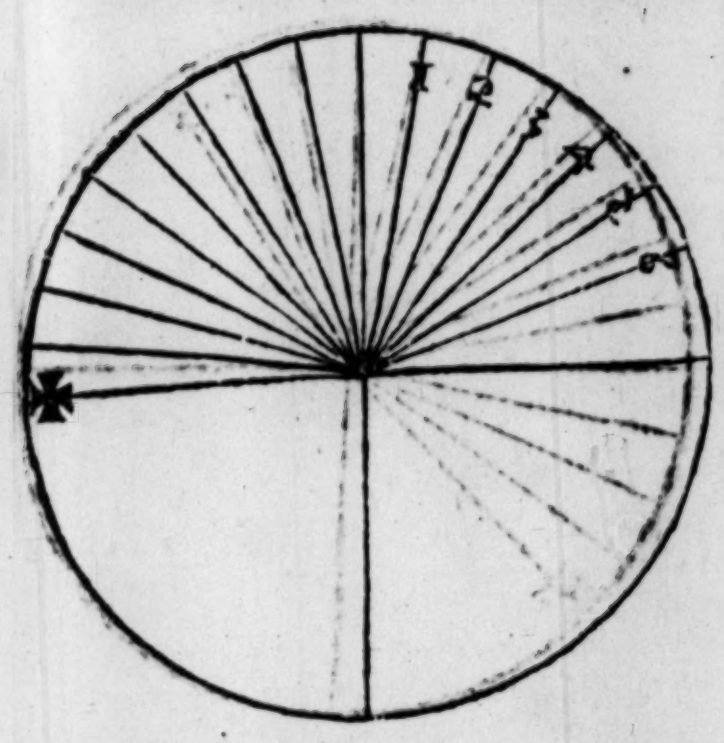
When you ſhall ſayle by the eight Courſe.



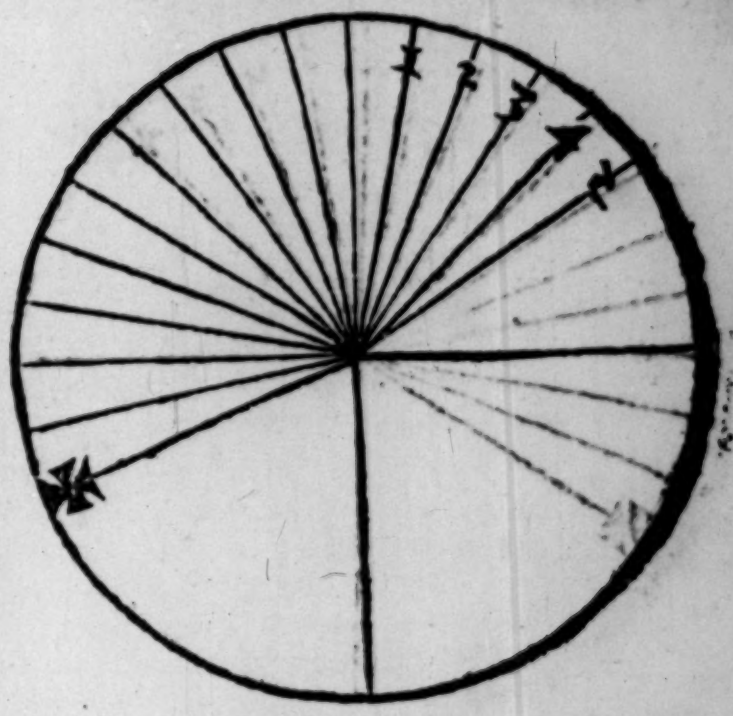
Leagues of the way.	Courſes.	Leagues of diſtance.
xx	1	xc v
lx l	2	xc v
xl	3	c v
lxxx	4	c x
c x	5	c xxc v
c l v	6	c lx v
cc xl	7	cc xl
cccc xc	8	cccc lxxx

Leagues of the way	Courſes.	Leagues of diſtance.
xx	1	c
xl	2	c x
lx v	3	c xx
xc v	4	c xcx v
c xl	5	c lxx v
cc xxx v	6	cc l viii
cccc lxx	7	cccc lxxx

When you ſhall ſayle by the ninth Courſe.



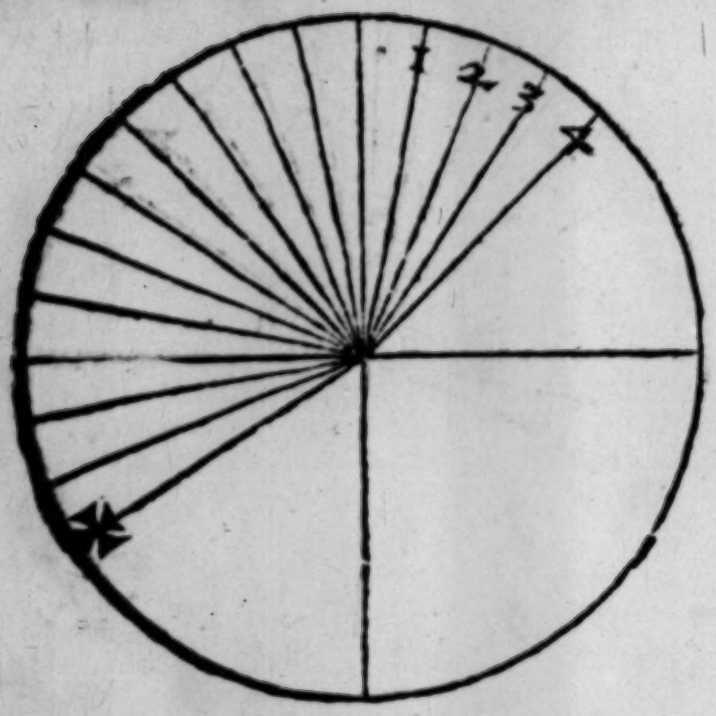
When you ſhall ſayle by the tenth Courſe.



Leagues of the way.	Courſes.	Leagues of diſtance.
xx	1	c iii
xl b	2	c x b
lxxx	3	c xl
c xx b	4	c lxx
cc b	5	cc l
cccc xl b	6	ccccixx

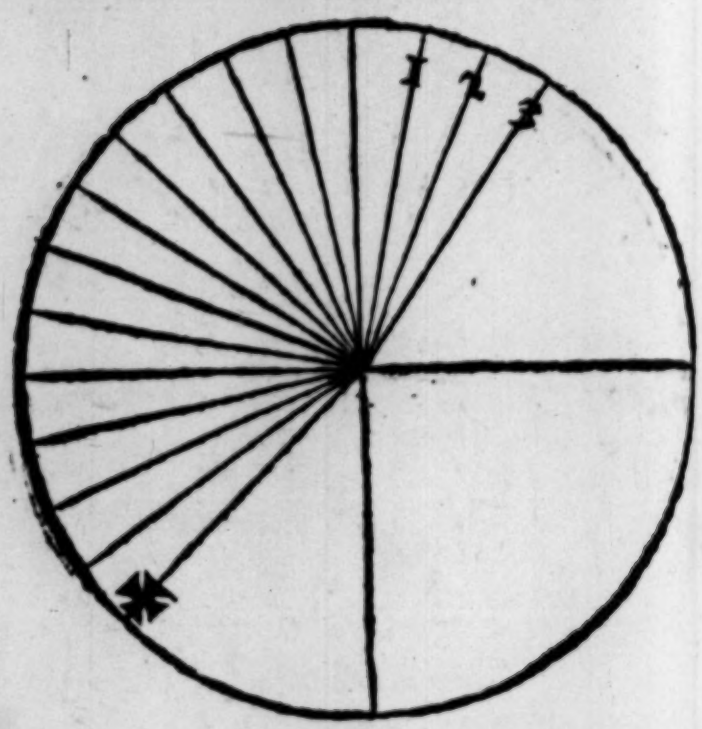
Leagues of the way.	Courſes.	Leagues of diſtance.
xx	1	c x
l b	2	c xxx
c	3	c lx ii
c lxxx	4	cc xl
cccc xl	5	ccccixx

When you shall sayle by the eleuenth Course.



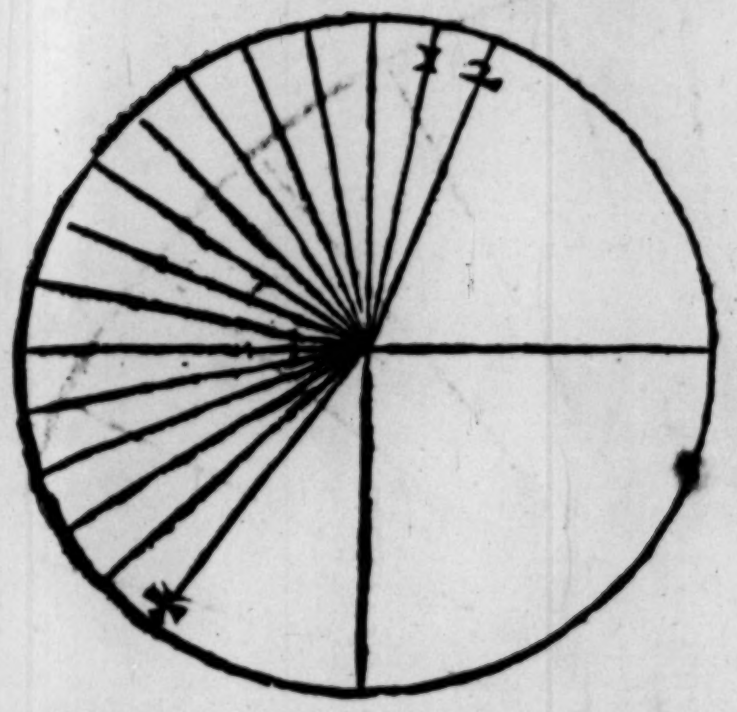
Leagues of the way.	Courses.	Leagues of distance.
xxx	1	c xx
lx	2	c l
c xl	3	cc x
ccc xxx	4	ccc cx

When you shall sayle by the twelfth Course.

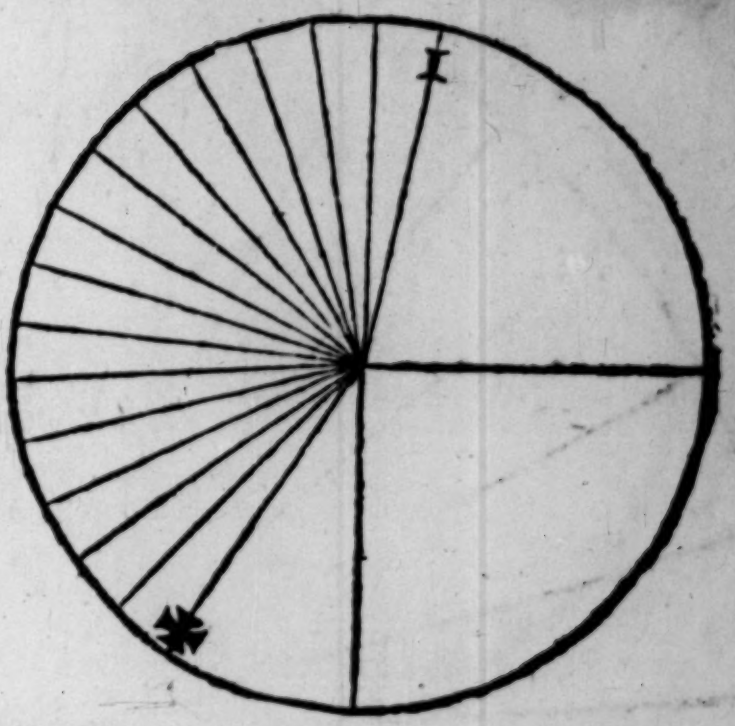


Leagues of the way.	Courses.	Leagues of distance.
xxx	1	c xx
c	2	c lxxx
cc xc	3	ccc lxx

When you ſhall ſayle by the thirteenth Courſe.

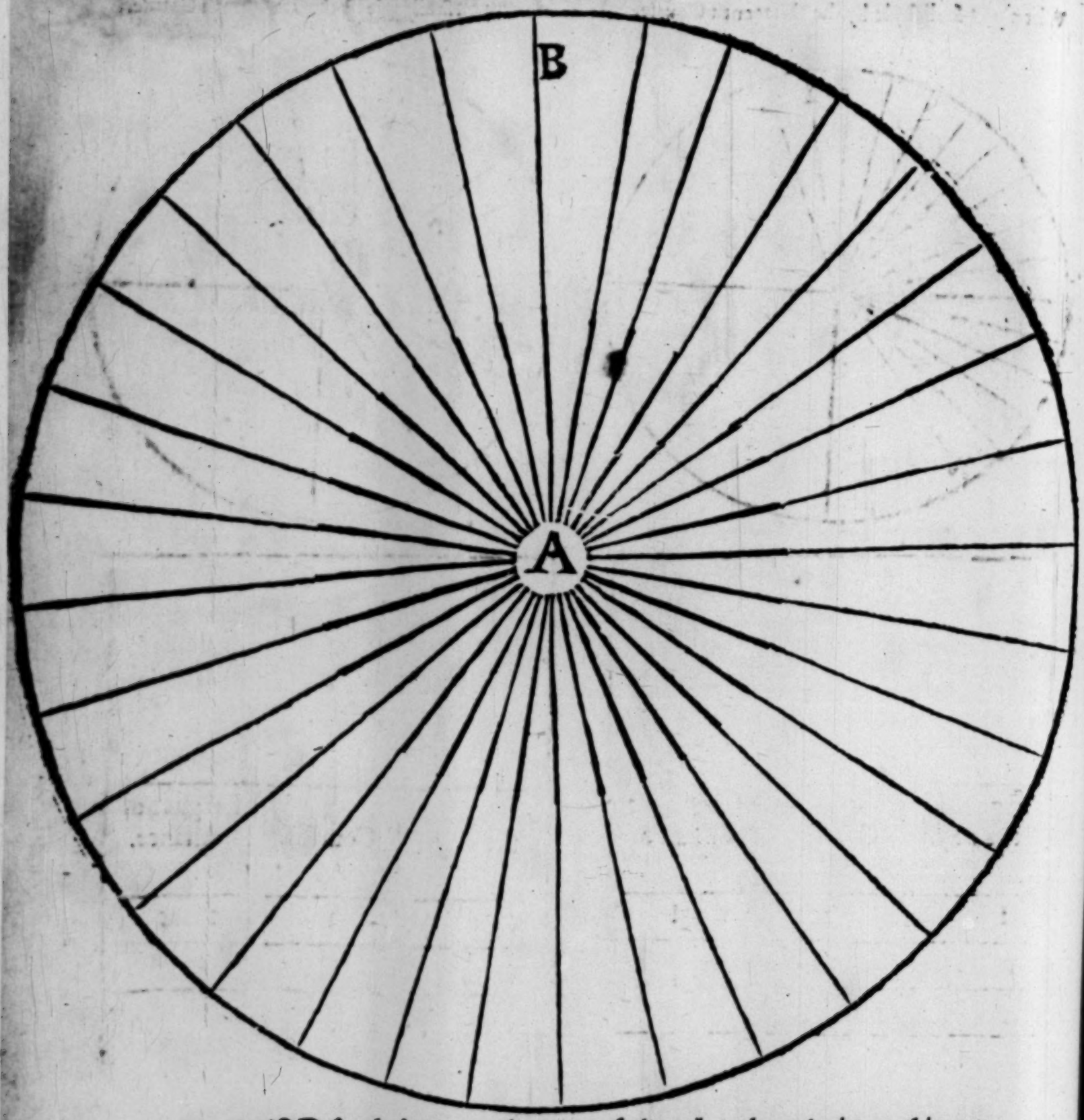


When you ſhall ſayle by the fourteenth Courſe.



Leagues of the way.	Courſes.	Leagues of diſtance.
1	1	c xl
c xc	2	cc lxxx

Leagues of the way.	Courſes.	Leagues of diſtance.
c	1	c xc



AND for the better declaration of the rules aboue written, this preſent figure is to be noted in the which I ſay that you finde your ſelfe, in the point A. and the land whither you will goe, you haue it: I put the caſe at the North in the point B. and there is from you to it an hundreth leages, ſo that your way ſhould be from A. vnto B. that is to ſay, ſayling from the ſouth

towards

towardes the North, and because you haue not this winde, you saile by the first course, and the account being put in the first rule, doth teach you, that if you goe fiftie leagues by this course, that the Land which you had first towards the North, you shall haue it at North and by East (you saying by the course of North and by west) and there shall be from you to it fiftie leagues, and if you goe by the same course fiftie seauen Leagues, then you shal finde it towards the North northeast, and then it will be from you to it forty leages. And if you sayle seauentie sixe leagues, you shall haue it towards the North-east and by north, and there will be from you to it twentie eight leagues.

And so in the rest this rule teacheth you how many leagues should be sayled for to get to the land whether you goe to all these courses. The second figure and rule is, when you shall sayle by the second course distant from the proper winde, in the which you shall finde the account that shalbe kept in that way. And the third for the third course, and so for all the rest: and it is to be noted, that to this winde at North which was put for an example, shalbe giuen the proper name of the winde whereby you should sayle, and to the others the names of the windes that are nert to him.

Also it is to be noted, that alwaies it must be considered what distance is from the place where you are, vnto that place whether you minde to goe, whereby you may make the account, euen as before is declared.

The ninth Chapter, how the Pylot shall certainly know sayling by any manner of course, where the Meridian is.

AND seeing that in the rules before written hath beene declared how the Pylot shall know whersoeuer he shal sayle, and to what point or course of the Compasse he hath the land whither he goeth, and how many leages the land is from him. Here I will speake, that departing from one place for to sayle to another by any manner of course, you shall know how much you departe from that Meridian wherein you were, and know the Meridian wherin you finde your selfe, for this is a thing most necessary in the Nauigation, the height or altitude onely excepted. And because this rule of the Meridian may be the better vnderstoode, you shall note this example.

I say that eight Shippes being in one Porte, and they goe forth sayling the one from the North to the South, the second by the first quarter, the third by the second, and so all the other by different windes, when euery one of these Shippes haue gone one degree, or two, or more, being equall in degrees, they shalbe East and west all of them one with the other, although not equall in way, for the one hath gone much more then the other, in such sorte, that that which hath sayled by the second course, hath gone more way

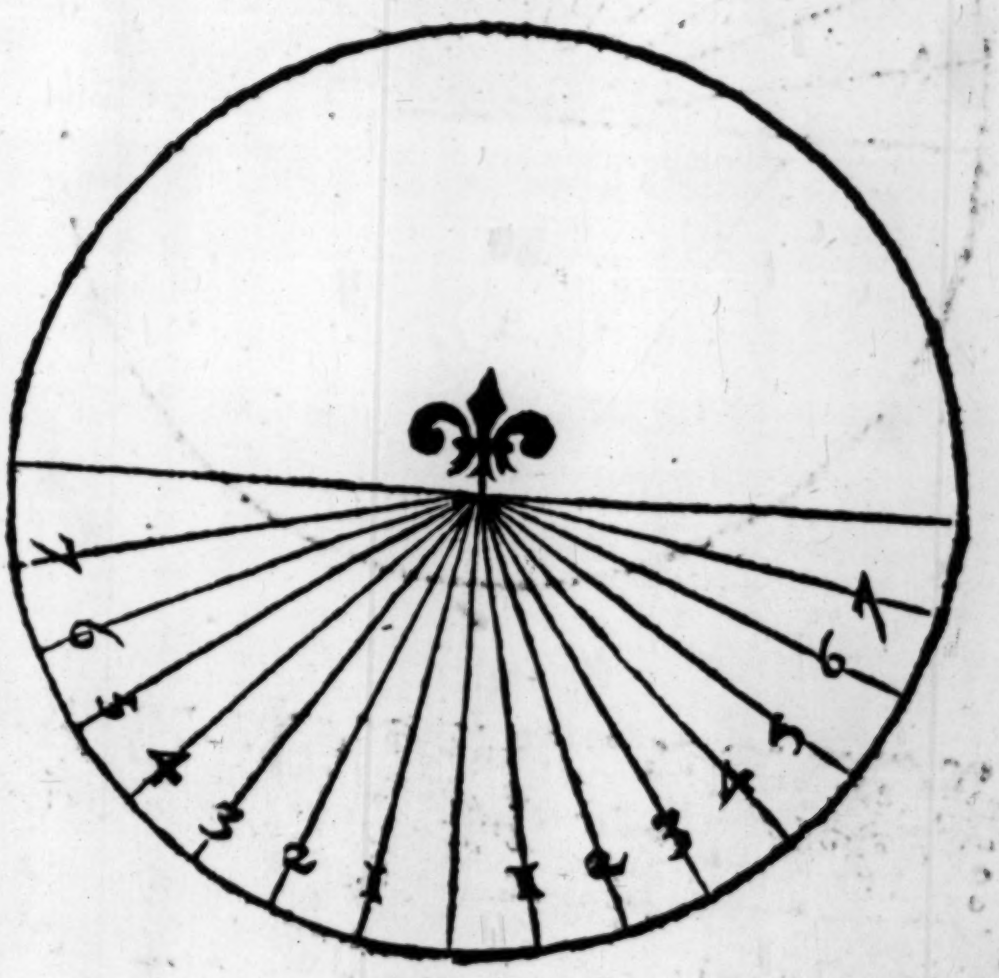
then

then that which sayled the first, and the third more then the second, and so of the rest: by how much they goe from the first, so much the more way is to be gone to raise vp or descend a degree. This is caused by reason of the obliquitie of the courses, as more largely shalbe declared in the 14. Chapter of this second Booke, and this being knowne, (I say for to know) how farre a man is from the Meridian from whence he departed, imagine that his navigation should be by the same Meridian, that is to say: from the North to the South. or from the South to the North, and that he sayled by the first, the second, the third, or fourth course, or by any of the other, according as the course lyeth whether you minde to sayle, to one place, or to another. And this is to be understoode in the fourteene courses Colaterals, from the North to the South, or from the South to the North: according as in the first figures which are put heere doth appeare: for because for the other fourteene courses Colaterales, from the East to the West, in the second figure or table they are declared: therefore I say when you shall sayle by any of these 14. courses heerefore declared, two things must be considered. The firste in what height of degrees you were when you were in them, and in what height you doe presently finde your selfe in: and look how many degrees of difference are from one to the other. The second is to looke by what course you haue come vnto the place where you are, and this being knowne, looke into the account heerafter written in the first table, and in it you shall finde how many leagues you haue departed from the Meridian, which you had in place from whence you departed.

An Example. I say, that you departe from the point of these first marked figures following, and so you were in 20. degrees of height, and after that taking your altitude, you found your selfe in 15. degrees, or in 25. in such sorte, that you found to haue raised or descended fiue degrees, and this was sayling by the fourth course, whose name you shal know looking on the fourth where he is marked in the figures which are heere put, and the course being knowne and agreed with that which you haue sayled, looke in the table which is next in the fourth course at the fiue degrees, and you shal finde that you haue gone from the Meridian from whence you departed 87. leages. And for the better understanding of this rule, imagine that from this point of the twentie degrees where you were, or from any other place from whence you departed, there departed likewise another Ship from the same point, sayling by the same Meridian, and that when you had gone the fiue degrees, she likewise had gone other fiue, in such sorte that you haue her East and West with you, and so it is to be vnderstoode that these 87. leagues are of distance from you to this Ship, because you are so farre distant from the Meridian. And so knowing the distance which you haue from the Meridian where you departed, forthwith you shall know the Meridian where you are, and in this sorte imagine

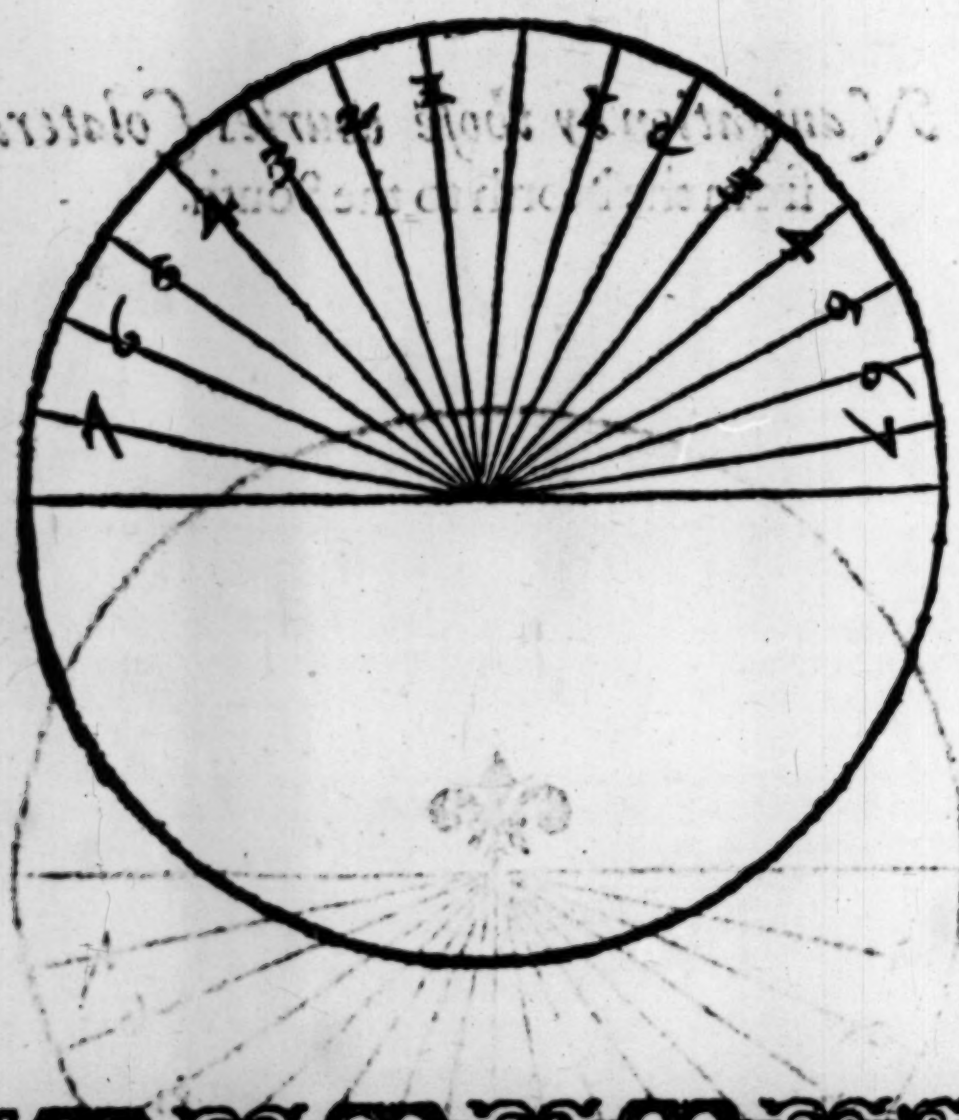
gine that any manner of course that you shall sayle by any of these that are marked heere vnder in the two first figures, you haue this ship East and west with you, and this shalbe your guide for to know how farre distant you be from the Meridian where you were, this is by seeing how many leagues you haue raised or descended, and the course whereby you haue sayled, and being sought in the figures and table following, by it you shall know the Meridian certaine wherein you are.

The Nauigation by those courses Colaterales from the North to the South.



The

The Nauigation by those courses Colaterales from the South to the North.



A Table of the nauigation from the North to the South, or from the South to the North.

When you ſhall ſayle by the firſt courſe.									
Degrees.	i.	ii.	iii.	iiii.	v.	vi.	vii.	viii.	ix.	x
Leagues.	3	7	10	14	17	21	24	28	31	35

When you ſhall ſayle by the ſecond courſe.									
Degrees.	i,	ii.	iii.	iiii.	v.	vi.	vii.	viii.	ix.	x
Leagues.	7	15	22	30	37	45	52	60	67	75

When you ſhall ſayle by the third courſe									
Degrees.	i.	ii.	iii.	iiii.	v.	vi.	vii.	viii.	ix.	x
Leagues.	11	23	34	46	57	69	80	92	103	115

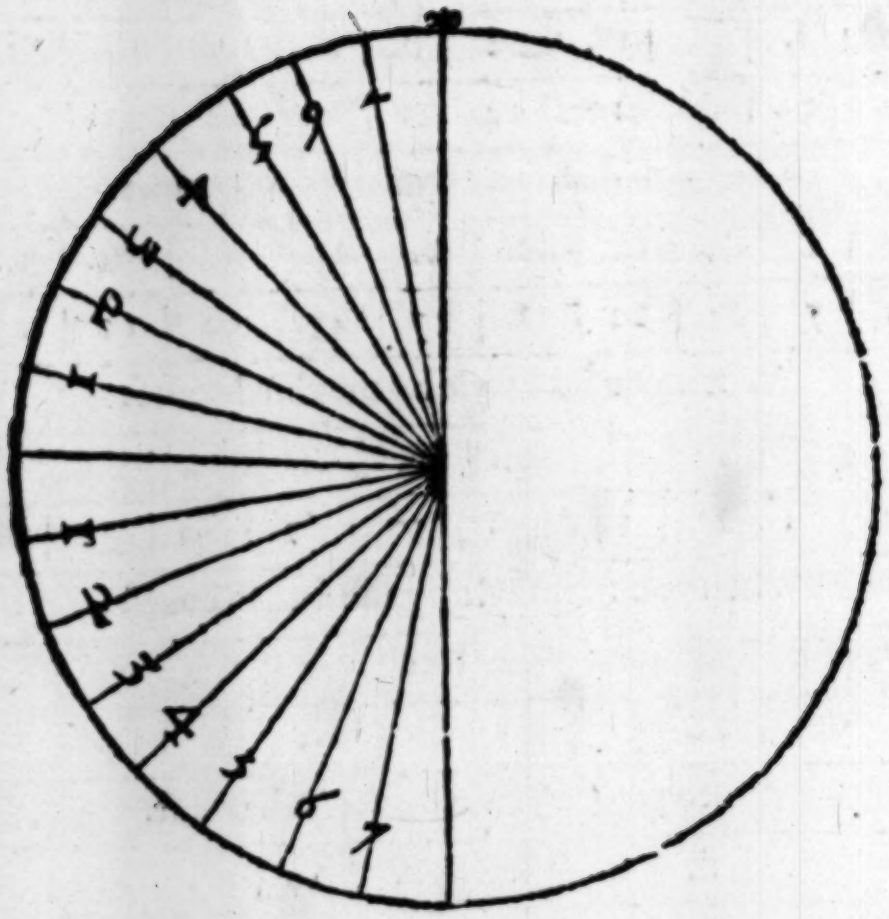
When you ſhall ſayle by the fourth courſe.									
Degrees.	i.	ii.	iii.	iiii.	v.	vi.	vii.	viii.	ix.	x
Leagues.	17	35	52	70	87	105	122	140	157	175

When you ſhall ſayle by the fifth courſe.									
Degrees.	i.	ii.	iii.	iiii.	v.	vi.	vii.	viii.	ix.	x.
Leagues.	26	53	79	106	132	159	185	212	238	265

When vou ſhall ſayle by the ſixt courſe.									
Degrees.	i.	ii.	iii.	iiii.	v.	vi.	vii.	viii.	ix.	x.
Leagues.	42	85	127	170	212	255	297	340	382	425

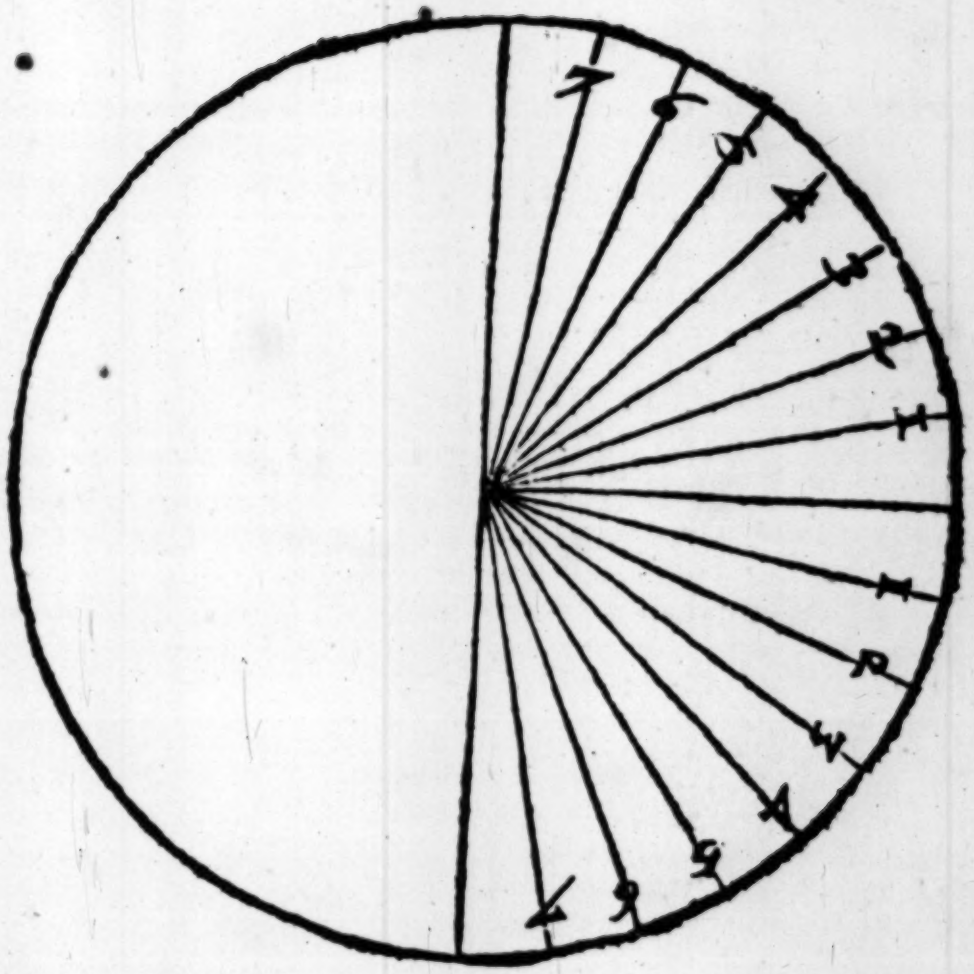
When you ſhall ſayle by the ſeauenth courſe.									
Degrees.	i.	ii.	iii.	iiii.	v.	vi.	vii.	viii.	ix.	x.
Leagues.	85	171	256	342	427	513	598	680	769	855

The Nauigation by the courses Colaterales from the East to the West.



The

The Nauigation by the courses Colaterales, from the West to the East.



E. A

A Table of the nauigation from the East to the West, or to the contrary.

When you ſhall ſayle by the firſt courſe.									
Degrees.	i.	ii.	iii.	iiii.	v.	vi.	vii.	viii.	ix.	x
Leagues.	85	171	256	342	427	513	598	680	769	855

When you ſhall ſayle by the ſecond courſe.									
Degrees.	i.	ii.	iii.	iiii.	v.	vi.	vii.	viii.	ix.	x
Leagues.	42	85	127	170	212	255	297	340	382	425

When you ſhall ſayle by the third courſe									
Degrees.	i.	ii.	iii.	iiii.	v.	vi.	vii.	viii.	ix.	x
Leagues.	26	53	79	160	132	159	185	212	238	265

When you ſhall ſayle by the fourth courſe.									
Degrees.	i.	ii.	iii.	iiii.	v.	vi.	vii.	viii.	ix.	x
Leagues.	17	35	52	70	87	105	122	140	157	175

When you ſhall ſayle by the fifth courſe.									
Degrees.	i.	ii.	iii.	iiii.	v.	vi.	vii.	viii.	ix.	x.
Leagues.	11	23	34	45	57	69	80	92	103	115

When vou ſhall ſayle by the ſixt courſe.									
Degrees.	i.	ii.	iii.	iiii.	v.	vi.	vii.	viii.	ix.	x.
Leagues.	7	15	22	30	37	45	52	60	67	75

When you ſhall ſayle by the ſeauenth courſe.									
Degrees.	i.	ii.	iii.	iiii.	v.	vi.	vii.	viii.	ix.	x.
Leagues.	3	7	10	14	17	21	24	28	31	35

The tenth Chapter, wherein is declared, more of this rule before written.

For it is not onely necessary to know the Nauigation which is made from the North to the South, and so contrary: but also that which is made from the East to the West, or from the West to the East, (that is to say) by these courses their Colaterales. Therefore I haue put the demonstrations and table before written, of the which is to be noted, the same order that is in the Nauigation from the North to the South, or from the South to the North, as it hath beene declared. The which is, when you goe sayling you shall marke in how many degrees of height you finde your selfe in, and after that when you turne to take the saide altitude, you shall marke how many degrees you haue risen or descended from the place from whence you departed. And this being knowne, look vpon the figures before written, the course whereby you haue sayled, and if it be the first, the second or third, or any of the others, and the course being knowne, seeke it in the table, and in the same course looke the number of the degrees which you haue gone, and neere to the degrees you shall finde the leagues which you haue sayled. I speak of an example, that taking your altitude you found your selfe in 30. degrees, and after that you founde your selfe in 32. or in 38. in such sorte you rose vp or descended 2. degrees, and you sayled by the third course:

Therefore looke in the table in the third course at the second degree, and you shall finde that you haue gone fiftie two leagues, and in this order you shall know the rest.

And note that in these tables there are put *noe* more numbers then vnto tenne degrees, the reason is, that whilest these be a sayling by any manner of course, there will be place to take the altitude, and being taken, to marke the place, and from thence to begin the account as well rising as descending, and in this sorte you shall goe, making a point in your Carde, and know the certain place where you are.

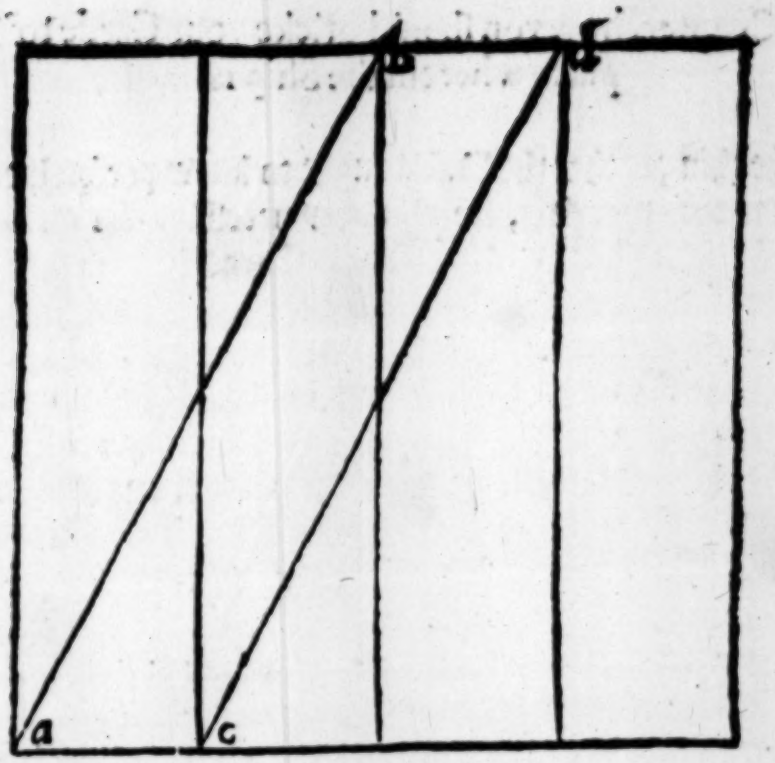
The eleuenth Chapter, how the Pylot ought to choose the course which is conuenient according to the place he mindeth to sayle vnto.

The Pylotte or any other person that mindeth to sayle, before all things hee ought to consider the waye that hee mindeth to goe, and so to choose the course or courses which are necessary, according to the way which he mindeth to make, and for this put before you a certaine rule, and this in any maner of place where a man standeth, is a pointe or beginning where the

courses or windes of the Nauigation doe proceede and come forth.

Therefore the Pylot ought to looke in his Carde the place where he is, and the place whether he mindeth to goe vnto, and this being knowne, he ought to seek for the course that may go most right to it from whence he doth depart, vnto the place whither he mindeth to go, and if there be a course that will carry him straight from one place to the other, let him put the foreparte of his Shippe vnto it as his Compasse will shew him, and by that course let him follow his way, as long as weather will serue him.

And when there is no course that goeth the right way, let him seeke with the Compasse the course that is most agreeable vnto him, which is it that will bring him least out of his way, to the place whether he mindeth to goe, and by the said course let him follow the degrees or leages which are of distance, vntill he findeth another that goeth more right to the place, and in this let the Pylot haue great care to see how much way euery course serueth him, and where he shall leaue that way and take another, and that he keep a good reckoning and knowledge of the waye that he maketh, as much as is possible, and at all times when neede requireth to make a point in his Carde and mone his course, let him do it keeping alwaies a good reckoning of his way, and this to continue vntill he finde a course that may carye him directly to the place that he desireth. And the Pylot in the beginning ought not to keep himselfe towards the courses that are neerest adioyning to him where he is, but vnto those that are neerest to the place whether he goeth. And it would doe well to pricke his Carde often, and prouide diligently vpon his course, and let the Pilot note, that for to choose the course the right way as he ought to doe, he hath neede to know precisely the Meridian where he is, for not knowing it, there may follow great errour, as by this example following appeareth.



If one Ship goe sayling, the Pylot maketh her to be in the point A. and would goe seeke for B. and in truth his point was the C. it is euident by reason he is ignorant and without knowledge of the Meridian, beleeuing that he sayled from A. vnto B. his nauigation was from C. vnto D. and therefore it seemeth that so much as is erred in the knowledge of the place where the Ship is, as much more she is distant from the place that she goeth to seek: and this is one of the causes whereby the Pylots doe finde themselues in great errour in their nauigation, and loose much time, and other inconueniences happen to them. Therefore let the Pylot take this for a good aduise, in long waies to keepe for himselfe a booke of account of his nauigation, where he should be put in remembrance of the winde that serueth him euery day, and in what sorte: and so how much the singlenes may be that his Ship maketh, looking by his clocke how many leages he may run euery houre, and you shall vnderstand, that the most which she can runne is foure leagues in an hower, and three leagues in an hower is a great runne, and in one hower two leages is reasonable, and in an hower to runne a league and a halfe or sometime but a league. It must be well looked vnto, and great aduise must be had in this, for it will profite much to pricke the Carde to know the Meridian, and therby to choose the true course as it is saide.

The twelfth Ceapter, how you should pricke your Carde to know the place wherein the Ship is.

ONe of the thinges that the Pylot ought to know perfectlye, is to pricke his Carde very precisely, for it is very necessary for good nauigation. Therefore when the Pylot will pricke his Carde for to know where he is, he ought firste of all to looke in his Carde the place from whence he departed, in what height of degrees it is in, according as he shall finde by the graduation which the Carde hath, and let him looke also in how many degrees of height he findeth himself in according as he took it, and this being known, let him take his two Compasses, and put the point of one of them in the place from whence he departed, and the other point of the same Compasse let him put in the course or winde which he hath had, and take the other Compasse and put the one point in the degrees of height which he hath found, seeking them in the graduation of the Carde, and the other point of this Compasse in the winde East and West that is nerest, and make these Compasses to runne the one vnto the other, not taking away the two pointes which come vpon the windes (that is to say) the one is it which the Ship hath gone, and the other the East or West, and comming in this manner where ioyntly you shal ioyne the two pointes of both Compasses, the one which was put in the place from whence the Ship departed, and the other in the height or altitude wherein ye found your selfe. In this point is the place wherein the Ship is, and to know if this point be certain, make the proofe in this manner. Looke in the pointe where you finde your selfe in, and from thence with the Compasse measure how many leagues are from it to the place from whence you departed, and this being knowne, looke into the winde that brought you how many leages is to be reckoned for a degree, according as you shall finde in the fifteenth Chapter of this second booke, and being seene, how many degrees you haue raised or descended from the place where you departed, vnto the place where you make your selfe to be, you shall reckon the leagues that these degrees doe amount vnto, and if the leagues of the degrees be iust with the leagues that you finde of your way, your reckoning is good: and if the reckoning be not agreeable the one with the other, looke wherein the errour is, for because that these two summes or reckoninges should come iust. And if the place where you finde your selfe be iust in altitude with the place from whence you departed, heere is no rule that can instruct you iustlye that which you haue sayled, but by iudgement that which your Ship may goe, according to the daies and houres that she hath sailed, and according to ỳ wether she hath had, and so the reckoning is made little more or lesse. But let ỳ Pylot marke that in this account or reckoning of little more or lesse, ought to be considered the currents

or

or tydes that may be in your way, for that many times the winde and tyde are one way, and when it is so the Ship runneth more way then the Pylot thinketh: at other times the windes and tides are contrary, in such sorte that as much as the winde carrieth, so much the current or tide retaineth or keepeth backe, and for this cause you ought to consider, that if the winde bee cast the Ship to one parte, and the currents to another, the race of the Ship will be in that part where is lesse strength or power, and if the winde and the currents be equall, the race of her will be of that side where the current is. Let the Pylot consider the falling downe or holding up that the Ship may make, and so let him make the account that is conuenient. This aduise is to be had when he pricketh his Carde by squarenes or by fancie, which is by reckoning the singlenes that the Ship hath made, and arbitrar or iudge how much way it may be that she hath gone in euery one, and by what course of all these the pilot must keep a good reckoning in his nauigation, as much as in him lieth.

The thirteenth Chapter, how the Pylot ought to looke that his Carde be iust and certaine, that there be no errour in his Nauigation.

IN the Chapter before hath beene declared, the manner that the Pylot or Sayler should haue in the pricking of his carde, and know the place where he is, and because my intent is to declare how the Saylers should know to make their nauigations without perrill or danger, as well of the ignorance of the rules and instructions of the nauigation, as also to know the defects of the Cardes and instruments wherewith they gouerne themselues by ỳ Sea.

I say, let the Pylot or any other person that shall sayle, be wel aduised that the Carde which he shal pricke and order his nauigation by, be iust and true, as well in the courses as in the setting downe of the coast, in such sorte that euery one thing be in his proper place both true and certaine, as well in the courses as in the altitude, so that the errour or defect of the Carde be not occasion that in nauigation you erre: and you must note that among the Cardes of Nauigation that vntill now haue beene vsed in the way of the Indians of his Maiestie, there are many which haue two graduations different one from the other: in such sorte that from one graduation to the other is more then 3. degrees of difference: these Cardes are false, and in the nauigations that by them are made may follow much hurte and great inconuenience, by reason of the difference that these two graduations haue betweene them, because their difference doth cause that all the courses that reach from one graduation to the other are false, being seen from the place where they begun, vnto the place where they make an end. The reason is, that as they begin in one graduation and make an end in another that is different from that: so the said courses do make the selfesame difference, and so the waye that is sayled by them shalbe

erred, and you shall not haue the place that you doe seeke by it: seeing that the Portes, Bayes, Ilandes, and shoolues, and the other things of the cardes, where these saide courses doe begin, being looked on where they end, they be forth of their owne places and true altitude, making it equall with the altitude where the nauigation began. Also looking in euery course of the carde, the distance of leagues that are from one place to another, or from one Porte to another: I say, from the place where ỳ course began, vnto the place where it endeth: and these leagues being taken with the Compasse, and the leagues being seene which are reckoned for a degree in euery course of the nauigation shalbe found, that the leagues of the courses be not agreeable with those leagues, which are of the distance of the way. This is in the courses that doe reach from one graduation to another, the which is caused by reason of the difference that the two graduations haue, so that by these saide cardes cannot be made any good nauigation, seeing that they in themselues do varie: likewise because they haue two Equinoctiall lines, and many other errours, all the which I haue made declaration of before. The Counsell royall of the Indians of his Maiestie, whereupon it hath been commaunded that the said cards be not vsed, by reason they haue two different graduations, and therefore are false and erronious as it is saide. Therefore I say that the Pylot or Sayler ought to looke well that the Carde whereby he doth saile be of one only graduation: I will say if they haue two graduations or more, let them be equall or vniforme, and not different the one from the other. And likewise the other instruments, let them be certaine and true, that they cause no errour, whereby may follow hurt and danger, as it is most certain, that with false instruments it may and doth oftentimes happen.

The fourteenth Chapter, of the number of the leagues which are reckoned for a degree in euery course of the nauigation.

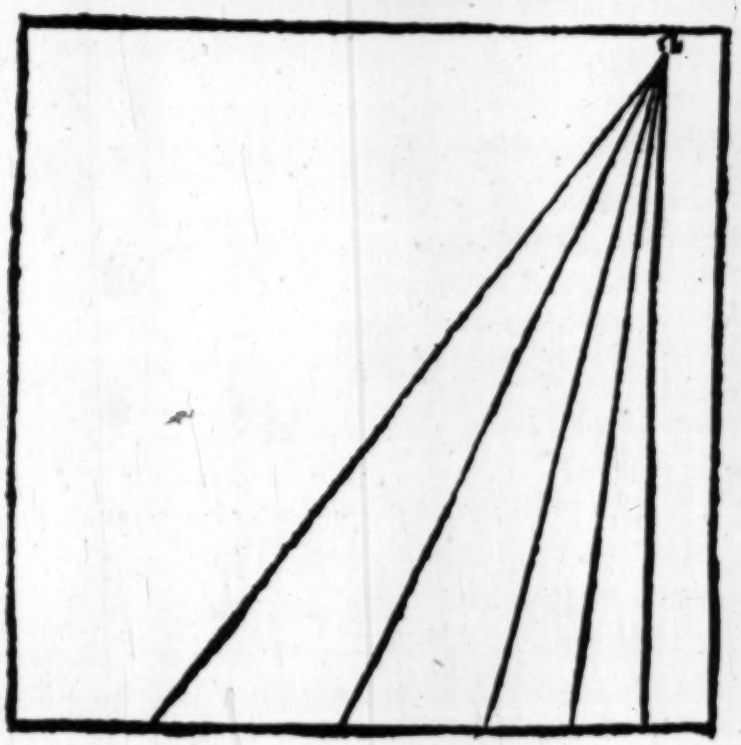
FIrst before I declare the number of the leagues that ought to be giuen to euery degree in euery one of the courses of nauigation, it is conuenient to speake heere what is the cause wherefore to the roundnes of the World, from the East to the West, or from the North to the South, was giuen to euery degree 17. leagues and a halfe, and no more. And in the other courses, although they be equall with these, are reckoned more leagues for a degree then in them.

To this is to be noted, what degree is taken in one of two sortes, is to be vnderstoode a degree of the roundnesse of the World, or a degree of eleuation or height of the pole. For the first which is a degree of roundnesse, in this all the degrees of the courses or windes be equall, for all the windes are as the greater circles in the Sphere, and as it hath beene declared, they haue three hundreth and sirtie degrees of longitude, and for that cause is giuen to euery degree of roundnes seauenteene leagues and a halfe: but in the second

manner,

manner, which is the degrees of the eleuation of the Pole, these are different vnto those of the roundnesse. For if in sayling towards the North, going 17. leagues and a halfe, the Pole is raised a degree, when you saile towardes the Northeast, although you goe these 17. and a halfe, you haue not raised ỳ pole a degree: but it is necessarye that you goe by this course 24 leagues and a halfe, for euerye degree of eleuation of the Pole, and like in all the rest of the courses, by how much euery one is more straight from the pole vnto the lyne: so many more leagues or lesse shall be gone for euery degree of eleuation of the pole, so that the roundnesse wherewith the Worlde is girded, in not to be looked on in all the courses of the nauigation. But doe you also looke how much should be gone by euery course for to raise vp or to put downe euery degree of the height of the pole, because this altitude of the pole is to be reckoned from the halfe of the Worlde, which is from the Equinoctiall line: for that from thence they begin to reckon the degrees, as well for the part of the North, as for that of the South, so that in the Cardes of nauigation are put the coasts and all the rest that are marked in it, according to the degrees that euery thing is distant of the said line: in such sorte, that sayling by any manner of course, from what place a man is in, towards the Equinoctiall, or from the said Equinoctiall or any other parte, by as much as the course is more straight or crooked, by so much they shall reckon more or lesse leagues in euery degree, in this maner.

The Equinoctiall line.



Apus

I put the case that two Ships be in the point A. which is a port towards the North, fiue degrees distant from the Equinoctiall, and both of them doe departe from thence towards the said line, and the one departeth with north, and the other with Northeast towardes the Southwest: it is certaine, that the which carrieth the winde at North, sayling by the same course from the North towards the South, after that she hath gone a hundreth and fiue leagues, which are the saide fiue degrees, by that course she shalbe in the Equinoctiall, and the other that sayleth with Northeast towards the South west, by reason that that winde goeth more leaning towards the said line, the waye is longer to her. And so although that in the altitude she goeth not downe more then fiue degrees, but for to come the Equinoctiall she shall goe one hundreth fortie seauen leagues, by the which shee hath euerye degree by this course 24. leagues and a halfe, so that onelye from the North to the South, and from the East to the West: and contrariwise euery degree hath seauenteene leages and a halfe, but in the other courses euery degree hath the leagues following.

The second course hath a hundreth and eight leagues deuided into fiue degrees, which commeth forth euery degree 18. leagues.

The third course hath a hundreth and fifteene leagues and a halfe, so that euery degree hath nineteene leagues and a terce.

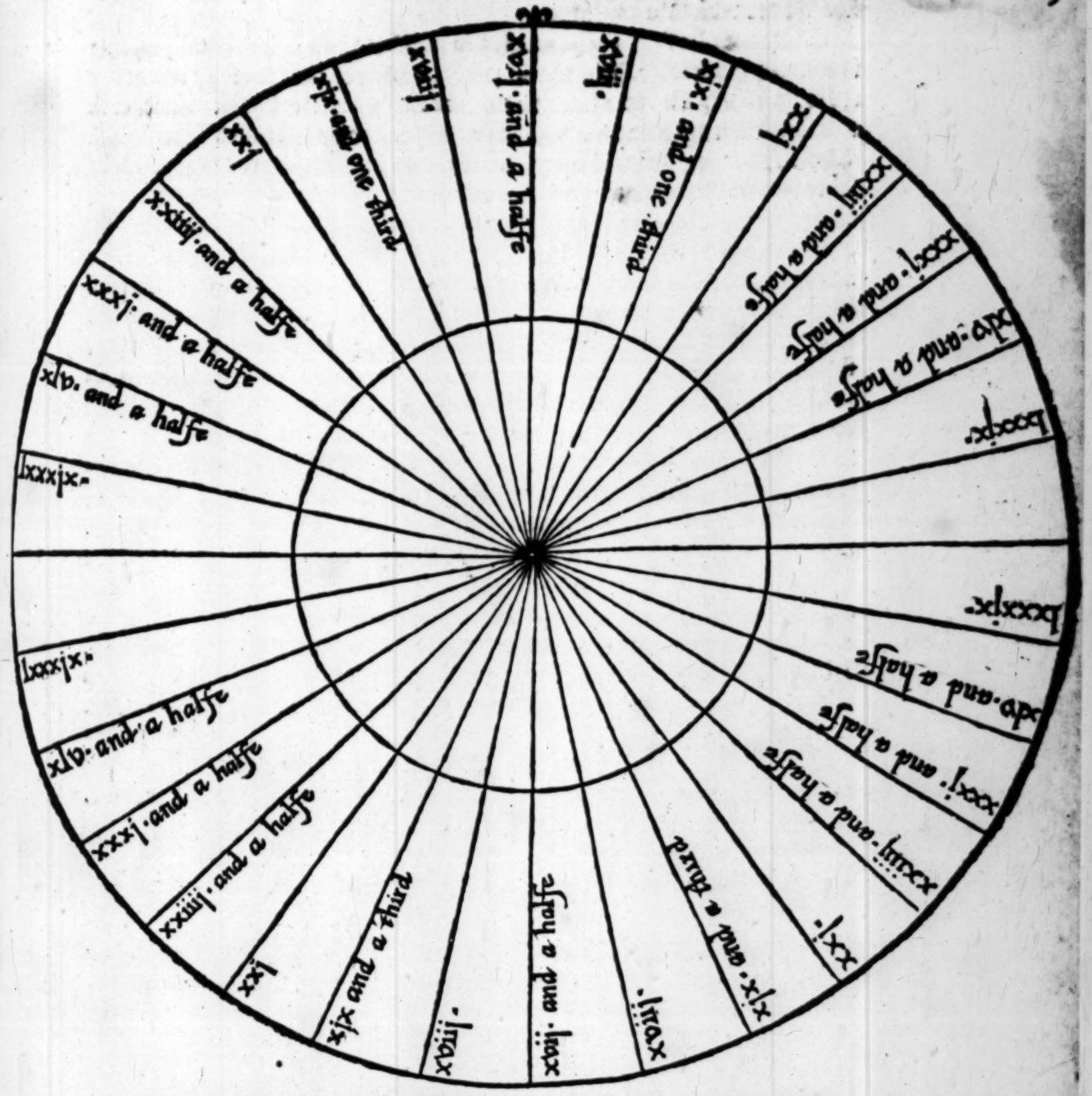
The fourth course hath a hundreth twentie fiue leagues, so that euery degree hath 21. leagues.

The fifth course hath a hundreth fortie seauen leagues, so that euery degree hath 24. leagues and a halfe.

The first course hath 189. leagues, so that euery degree hath 31. leagues and a halfe.

The seauenth course hath 273. leagues, so that euery degree hath 45. leagues and a halfe.

The eight course hath 535. leagues, so that euery degree hath eightie and nine leagues.



The fifteenth Chapter, of number, and measure, and of how many partes a degree is compounded.

IT is written in the Booke of Wisedome, that God made all thinges in number, waight, and measure, therefore without knowledge of the numbers we can know nothing, of the time, of the howers, or of the mouings, or other thinges, by the which it seemeth that without knowledge how to reckon

kon we cannot know any thing.

There are two ſortes of quantities, or numbers, one is continuall, another is deuided or diſcreete. The continuall is in 3. ſortes, that is to ſay, towardes the length onely like to a line, and this is called quantitie lineall: Another is continued in length, and bredth, but not deepe, and this is called ſuperficiall. The third is continued in length, bredth, and depth, and is called corporall or ſet together. The quantitie deuided or diſcrete, is when wee ſaye, one, two, three, &c. whereby it ſeemeth by the diuerſitie of the numbers are vnderſtoode diuers meanings of writings, and ſo he that knoweth them not, ought not to be called a man. Plato ſaith, for this cauſe is man ſo wiſe a creature, becauſe he knoweth the manner how to account: for the which he had written at the doore of his Academia, that who could not make a reckoning or account, ſhould not enter in to heare him. The meaſures and the reaſons for them and their properties haue ſprong of Geometrie, for Geometrie is a ſcience of meaſure, the which doth containe lines, ſuperficies, and bodies, as appeareth in any circle three ſquare, foure ſquare, and other figures of Geometrie: many Authours haue written, and principallye Euclides the Father of Ypocras, Plutarch ſaith, that Archimedes made an artificiall thing by Geometrye, with the which Marcellus a Captaine of the Romaines hauing beſieged the Citie of Syracuſa in Sicilia, with the ſaid artificiall thing Archimedes took out the Ships of Marcellus that were in the Sea, by railing them vp into the aire, he put them within the Cittie: this ſcience is called Geometrie, as S. Iſidore ſaith, for the diſtribution of lands and fieldes: Geometrie properly is of the corporall things, for that al corporal things haue their proper meaſure.

And of the ſpaces or diſtances that are from one Prouince or Citie to another, which are meaſured by Eſcadios, Miles, Leages, and degrees. And this meaſure wherby that all may be alike in equalitie is ordained in this maner.

Foure graines of Barley doe make one finger.

Foure fingers one hand.

Foure hands one foote.

Fiue foote maketh one pace.

An hundreth twentie fiue paces maketh one Eſcadio.

Eight Eſcadios which are a thouſand paces, doe make a Mile.

Three Miles doe make a league.

Seauenteene leagues and a halfe doe make a degree.

Euery degree hath 60. minutes.

Euery minute 60. ſeconds.

Euery ſecond 60. thirds. And ſo vnto tenthes.

The reaſon why this account is deuided into this number of 60. more then into any other. Ptholomie declareth in the firſt of the Almageſto the 9. Chap. where he ſaith, that the Aſtronomers ſought a number that hath many numbers

bers in proportionall partes, which we call partes, Aliquotas, and there cannot be giuen any other number vnder sixtie, for that this number may be parted into many deuisions and numbers, as in two times thirtie, in three times twentie, &c.

This second booke of the Windes should haue beene placed after this third booke following of the Sea, but that it was mistaken.

The third booke of the Sea, and of his mouinges,

and how the Nauigation was inuented.

The first Chapter, what thing the Sea is, and wherefore it is called Occean.

The Sea is the proper place of the waters, by reason of the similitude of his forme, there the waters doe ingender and are sustained. And according as Albertus the great vnderstandeth it, the riuers come forth of her, and returne to her again. So he saith in the third of his Metheoros the twelfth Chapter, we see that all riuers runne into the Sea, and from the Sea they returne and come forth, that they may runne againe, whereby it seemeth that the Sea is the end and beginning of the waters. It is called the Occean Sea for the swift and continuall mouing wherewith it moueth: for that Oikis in Greeke, is as much to say, hastie or swifte. The Greekes and Latinists doe name it by this name, and therefore this name hath continued common: or else it is called Occean Casi Ciancus, because it girdeth or imbraceth the endes of the earth, and by reason of the diuersitie of the Countries, it taketh diuers names, as the Indian Sea, or Persian Sea, &c.

The Sea hath no colour being looked vpon when one is neere it: for our light remaineth not vpon the superficies of the water, but descendeth downe, and being looked vpon a farre off, it hath the colour of heauen, and being moued of the windes, it hath the fourme of diuers colours. And it is to be noted, that the Sea for seauen daies riseth encreasing, and is that which we call spring tides, and other seauen she decreaseth. Of these flowings and ebbings Aristotle bringeth the causes to be naturall, in the second of his Metheoros: and besides that Hipocrates in his booke of aire and water, saith, that there is a proper cause in Astronomie, that is by the naturall vertue of the Moone vpon the waters, so likewise we see all shell fishe with the increasing of the Moone doe increase, and with the decreasing doe decrease: for as the Moone riseth aboue the Horizon, and with his beames toucheth the Sea, mouth a stirring vp, whereby it causeth her flowing and ebbing, and to cast out into her riuer or coast, all dead bodies or vncleane thinges that are in her.

The

The second Chapter, how the Sea appertaineth to the perfection of the Worlde, and without her the Worlde would perish, and how the water is ingendred in her.

THe Sea appertaineth to the making of the Worlde, and to her perfection, and the Worlde should not bee perfecte without her: for if there were no beginning of the waters there should be no simple waters, and if there were no simple waters there would be no mixt waters, and so there would be nothing of that which is ingendred of the water, and if there were no water there would be no bodies as there are continually, and things which cleeueth together: whereof it followeth, that if the waters had not a beginning, the generation would be destroyed, and so consequently all the Worlde.

Also if there were no beginning of the waters, there would not be a ioyning together of the contraries which are possible, and so nature would rye in that which were necessary, and the worke would cease in the act. Then it would happen, not hauing a beginning of the waters, the worke of nature would cease, and so the Worlde would perish: where it concludeth, that the Sea is necessary for the sustentation of the Worlde.

And Aristotle in the second of his Metheors saith, that the waters in the Sea doe ingender in the North, which is as much to say, as the greatest parte of the water of the Sea doth ingender in the North. This Albertus the great declareth in the second of his Metheors, Chapter sixe, saying: that the Sea runneth from the North into the South, and the cause is that the North is higher then the South, and the reason wherefore it is higher, is because that with the colde of the North there is more water ingendred, then that which can containe in the distance and height of the riuers, and in the South the water consumeth, and is wasted with the heate of the Sunne, and for this cause in the North one water pusheth out another to the place which is lower then it selfe: and so accidently it moueth from the place of his generation, for as it is moist it runneth vntill it come to be deteined in some drye place. The reason why the water is so consumed in the South parte, is because the Sunne alwaies moueth in his circle Excentrik, so that his center is not in one place of the earth, in such sorte that if the diameter of the circle of the Sunne were past by both centers, that is to say, his owne, and that of the earth, the greater parte of the diameter should be towards the one parte, and the lesser towards the other, in respect of the center of the earth. And so it is shewed by reason of Geometrie, that the greater length of the diameter is neere vnto the twentie degrees of Gemini in this our time, and the lesser length is in the twentie degrees of Sagitarius, which is a signe opposite to Gemini,

Gemini, whereof it appeareth that the Sunne commeth much neerer to the earth in the South partes then in the North partes. And so by reason of his neere comming he heateth in such sort, that he consumeth the water and burneth the earth, the which he doth not in the North partes.

The third Chapter, wherefore the water of the Sea is salte, and wherefore it is most conuenient and better for the Nauigation.

Experience sheweth that the water of the Sea is salte, and so saith Albertus the great, that it is called Sea, by reason it is bitter or salte: and the Sea to be salte it seemeth to be against his naturall kinde, wherefore seeing that the Sea is the beginning of the waters, and his owne place and the waters which ingender in her, and those which enter into her forth of the riuers are fresh, it seemeth that with more reason the Sea should be freshe and not salte. Also it is certaine that God made all thinges to the best, it seemeth to be better that the Sea were freshe then salte. To this answereth Albertus the great in the second of his Metheors, in the third treatie and fifteenth Chapter, where he saith the matter that causeth the Sea to be salte is: according to the truth there are two kindes of vapours, that is to say, hot and moist, and hot and drye: and in the Sea one of these doth rise from the superficies, and the other riseth from the bottome: this is by reason of ꝑ heat of the Sun, and of the Starres, which are an efficient cause of these vapours, and for the vapour of the water it is very subtile, betweene these two, and therefore being riseu into the aire, is consumed of the Sunne, and the vapour of the earth remaineth: or more properly his exhalation dispersed, extended, and mingled in the water. As it appeareth by an example in the meate digested, that the thinne substance thereof is raised vp and extended into the members, and is that which nourisheth, and the grosse substance remaineth, and also that which is undigested: euen so doth the vapour of the earth remaine grosse, and extendeth into the substance of the water of the Sea, and the coldues of the water compassing it round about, casting into it coldenesse, and with the coldenes it burneth, by reason they be two contraries together, they are made stronger then before: for the heate of the salte exhalation being come forth of the depth of the Sea, by vertue of the Sunne fortifieth it selfe with his contrary, which is the colde, and so ouercommeth the like heate, which is that as is required in the generation of a salte taste: as the Philosopher hath it in the second of of his Metheors the first Chapter, speaking in this matter, of this there is a similitude: that if a fresh water were passed through ashes it would make it salte, the like is of the water of the Sea, in the time it was made salt, and because that some say there is a pure element in substance, and the element of the

water

water is in the Sea, and that in the middest of the Sea the water is simple and without taste, wherfore hath it not there an obiection of contrarietie: this seemeth to me not to be so, for the heate of the Sunne and the Starres are sufficient to make exhalations come forth of the bottome of the Sea, which being mingled with the coldenesse and moisture of the water, causeth a salte taste in the highest parte of the water: as well and with more reason they will make it in the middest or in the bottome of the Sea, and so I holde with Aristotle and with Constantine a great Astronomer, that there is now no element pure, and forasmuch as the water is salte, it is more conuenient and better for the nauigation then the fresh, that is because the salt water is more heauie and grosse then the fresh. And that it is so, Albertus the great saith in this manner, that the salte water is more heaute and thicke then the fresh, it is gathered by many experiences, of the which one is. If the fresh water be mingled with salte, and made a strong mixture, in such sorte that all the salte be melted in the water, and into it is cast an egge fresh laide, it will swim aboue the water by reason of the thickenesse that the water hath, which is done with the mixture of the salte: and if the laide Egge be put in freshe water it will sinke. And by the same reason is shewed, that the Shippes doe rather sinke in fresh water, then in that which is salte: for the freshe rather deuideth it selfe, and riseth vp rather then that which is salte.

The fourth Chapter, of the different mouinges which the Occean Sea hath.

IT hath beene declared in the second Chapter of this third booke, that a great parte of the water of the Sea doth ingender in the North, and from thence it runneth to the South, and this is one of the mouings which the water of the Sea hath: we doe likewise see that the Sea when it floweth mooeth towards one parte, and when it ebbeth, it moueth to the contrarye, hauing such order, that where it began first to flowe, there it beginneth first to ebbe, whereby it seemeth that the water of the Sea hath contrary mouinges one from another, and besides this we see that the riuers runne to the Sea, and also the Sea commeth vp by them, and this seemeth meruellous in nature, for the water naturally goeth downward, as a body which is heauie, as it is: and if the riuers be higher then the Sea, the Sea should not goe vp into them: and if the Sea be higher then the riuers, they would not runne into the Sea, whereby with reason it may be doubted, saying.

A doubt, What is the cause seeing that all the waters of the Sea being one body, haue so many different and contrary mouings, so that some waters are mouing towards one place, and some towardes another, whereby it may be saide, either that the Sea moueth it selfe into these mouings by chaunce

and

and without any order, or that she is mooued by different mooumgs or mooners (A declaration,) To these doubtes Albertus magnus answereth, in the second of the Metheoros the first chapter of the third treatie where hee saith, absoluing all the difficulties, which are put, touching these mooumgs of the sea, we say with Seneca that there is no other ~~course~~ of the course of the waters, to one place or other, but the places which are high or low, (except that onely mooumg, whereby the sea ebbeth or floweth,) for in this it followeth the circle of the Moone, as we teach in another place: And that the saying of Seneca is true, it is proued because the waters of the sea doe come flowing to all partes of the world, that is to say, to the east, and to the west, to the north and to the south. And likewise they goe ebbing from all the said parts. And therefore the Sea hath no part proper where his flowing and ebbing doeth begimne, so that by accedent the water mooueth it selfe from one place to another, vnlesse it be downe right, for because this mooumg commeth not to it by any accedent but by proper essence, consequently to his forme.

cause.

The fifth Chapter wherfore the sea neuer ouerfloweth, nor is augmented nor made greater.

IT may be asked what is the cause, seeing that in the Sea there is so much water ingendred, and continually entereth into her so many riuers and fountaines, wherefore she neuer ouerfloweth nor is augmented. To this is some cause the which Albertus the great bringeth in the second of his metheoros where he saith, the sea receiueth no augmentation nor yet maketh it selfe greater, for because she is a naturall receiuer of all the waters, and is their quiet place. And the place cannot ouerflowe, with the comming in of the thing which by nature ought to bee in this place: for the place ought to bee conformable with that which it shutteth into it according to nature, so that the sea is able to receiue into it all the riuers. And for the entrance of them neither to ouerflowe nor to augment it selfe. Likewise it ouerfloweth not by reason that the Sea is so great that the riuers in the respect of her are nothing, for ther is not any thing in thē able to augment it. The third reason is because the heate of the sunne and the blowing of the windes doe consume so great parte of the water, that although it ingender continually in the sea and continually the riuers enter into her: yet in such order God disposed it ẏ it neither decreaseth nor increaseth. And so it may be sayd that which is written in Iob, Lord thou diddest appoint her a precinct, that she should not breake it. And it is to be noted, that in the floud of Noah. The holy scripture saith in Geneses the seuenth chapter, that the water did rise vp fifteene cubites vpon the most high mountaine that is vnder the heauen, so that all the earth was couered with water. But although that this encreasing of the waters were so great, the sea did not ouerflow nor did couer the earth, by going forth

of her limmet and precinct. But the great encrease of waters came for two causes, one was that the windowes and cloudes of heauen were openes, and it raigned fortie dayes and fortie nightes verye leisurly. The second was that the fountaines and riuers of freshe water did runne so much that all the earth was couered as it is said, so that all liuing things which were vpon the earth did perish (except Noah and all that were in the arke) But the rayne being ceased, the sayde text saith, that God sent such great windes, that they consumed the water, and returned the earth to his owne perfectnes.

The sixt Chapter of the excellencie of the Nauigation, and of the antiquitie thereof.

WIth reason it may bee sayde that the Nauigation hath great excellency seeing that God was the first that commaunded to make a shippe or instrument to goe vpon the water: so it is written in Geneses the sixte chapter where is sayd that God commaunded Noah to make a shippe or arke of timber. This arke had 300. cubites in length, 50. in bredth, and 30. in highe, of these cubites, there are diuers opinions what length they were of, some say after the manner of Geometry, others say common, with more reason it seemeth they were in maner of Geometry, because they should be greater, for it was conuenient that in the arke there should bee place for that which should be put therein.

S. Isidore writeth of the Nauigation in the Ethimologias that the Lidians were those that first found out the making of shippes, but these did not attaine to more knowledge then to ioyne one timber with another, and were well calked and nayled, they sayled in them not departing far from the land, after the Epaminundas, the Greeke made an end to put shippes to sayle in perfection and so in the warres of Peloponeso there was found that noble captaine, Bias with shippes, carrackes, and Gallies.

In the third of the kings in the 10. chapter is read that Salomon king of Hierusalem sent two shipps to Tharsis, and euery three yeers they went and came from whence they brought gold siluer, works of Iuorie, and apes.

Iulio Solino sayth that all the sea towardes the south, which doth compas Affrica about behind and from the India to Spaine was sayled, and of this he bringeth testimony of the king of Iuba for the confirmation and argument thereof he maketh mention of Ilands, and of a certaine people the manners and confines of the places and the spaces of them.

Plato in the 32. booke, in the dialogue of Timeo, saith that from an Iland called the columnes of Hercules, which is at the mouth of a straight, there was sayling to a firme land, which contained greater then all Affrica and Asia, wherby it appeareth that before the time of Plato was sayling from the Iland of Cadiz, which is at the mouth of the straite Iebualter vnto the land

Indias

Indias which we now haue.

Pliny writheth, that gouerning the thinges of the empire of Tiberius Cæsar there did appeare in the coast of the sea of Arabia signes of ships that the Spaniardes had lost. Cornelius Nepote giueth knowledge that in his time one that was called Eudoxie fled from the latine king sayling by the sea of Arabia, and likewise sayth that he saw one Celio Antipatro that sailed with marchandise from Spaine to Ethiopia. In the time of Augustus Cæsar for the most part of the north Ocean seas were sailed round about. Almaine, vnto the cape of the land of the Cimbros or Geldresses Seleuco and Anthioco say that the riuers of the Caspian sea were sayled and knowē with the armies of those of Macedonia: As also they sayled al the north parts from one place to another. Plinia himselfe vseth the testimony of Cornelius Nepote who affirmeth that the king of the Sweuians or Esquicaros gaue to Metello Celeri chiefe counsell of Fraunce certaine Indians the which sayling from the India with marchandise were driuen into Almain with tēpest of weather. Likewise it is read in Othom that in the time of the Iermain emperours certaine ambassadours of the India were found in the riuers of Almaine which were driuen thither with great windes, & it was not doubted that they came from the region towards the east, which could not be if it be as some doe thinke that the north seas be frosen. Pope Pio the 3. saith that in the booke he wrote of Geograpie and reasondoth manifest, and shew ý the sea in old time was sailed seeing that the men of old time did put names vnto the riuers of the Ocean sea, which doth cōpasse about the farthest parts of the earth, of the great number and multitude of ships that was in ole time some authors haue written. Homer saith ý in the host of ý Greekes which came vnto Troy were 1180. ships, likewise Diodorus saith ý Xerxes king of the Persians brought in his against Cretia, 700000 men of his owne, & 300000. of his frendes, and when he came to the Sea called Pontico, hee made in the sea a bredge of ships whereby hee past with his people so that the ships being togither, reached from the land of Asia vnto that Europa, which is at the least a league of sea.

The 7. chapter how by some signes of the sun and of the moone may be knowen when stormes will come.

MAny times there happeneth to be in the sea tempests of winds & waters which doe cause great stormes whereof followeth to such as are saylers death or losses of ships or goods or other great troubles: therfore here I mind to declare the signes as I find them writen by the which the said tempests or stormes may be knowen and being foreseen or known they may do les hurt. This pleased Virgil greatly who saith, that many hurtful battels of windes doe come vpon the ignorant: it is reade of Democrito the Philosopher,

chat a brother of his being reaping in time of great heat, who was called Damaso, the sayde Philosopher sayde vnto him, that hee should reape no more, but should gather together that he had reaped, and keepe it, for shortly would come a great tempest of wind, that would carry it away from him, And so a fewe houres being past. It followed as the Philosopher had said, after declaration made of signes or prognostication of the tempests or stormes, there shall be first noted, those which are shewed in the Sunne.

The signes of the Sunne.

Plinie in his naturall history the eighteene booke chapter forty fiue sheweth that if the sun when it riseth be clear and not cloudy, foresheweth a fayre day, if it seeme yellow, it foresheweth rayne with haile. If when the Sunne doth rise it seemeth hollow, it foresheweth rayne and wind, if when the Sun doth rise there be cloudes before it, and shew red, and part of the sayd cloudes are dispersed abroade towardes the North and parte towardes the South, it signifieth winds with great rayne: If when the Sunne riseth and setteth doe appeare any streekes gathered together neere it foresheweth rayne:

If before the Sunne rise do appeare vpon it round cloudes it foresheweth great cold, this is if after Sunne rising they goe towardes the South, but if they goe towardes they west it signifieth fayre weather.

If cloudes doe compasse the Sunne round about the lesse light and clearenes they giue, signifieth, the greater tempest, and it will be the greater if her roundnes doe seeme dubled.

If in the rising of the Sunne do appeare red cloudes lying ouer the sun being brought thither by any manner of wind it signifieth that the selfe same wind will blow, but if it be a southerly wind it betokeneth rayne.

If when the Sunne riseth it bee compassed about with cloudes from that part where the roundnes doth discouer, it is to be loked for that the wind wil come, but if it discouer all, it signifieth equally faire weather.

If when the Sunne riseth she extend her beames farre of, by the cloudes and in the middest it seemeth emptie, foresheweth rayne.

If before the Sunne come forth she shew her beames it foresheweth water and winde.

If when the Sunne shall set, her circle be white, it foresheweth some tempest that night, and if it be very hote, there will be wind.

If when the Sunne doth set, her round bodie doth seeme blacke or thike of the part which is most discouered, it will blow much winde.

The signes of the Moone.

Seeing there hath beene declared the signes of the Sunne, for to know the tempests or stormes that are to come I will speake of the things which are to come, that the moone sheweth.

In Aegypt they keepe holy day, the fourth day of the moone the which if she

the seeme shining with a cleane brightnes it foresheweth a verie fayre day, and if she shew redde it betokeneth much winde, if blacke it signifieth raine, if in the fifth day her hornes be not sharp and small, but great and broade, it foresheweth rayne.

If the moone be straigth and shew her selfe upward it signifieth winds and chiefely when this is in the fourth day.

If the moone being foure dayes olde, and her roundnes be of an Alborne culler it signifieth great windes, the authour hereof is Varro.

Plinie saith that if in the fourth day of the moone she be upright it betokeneth tempest in the sea: unlesse that all rounde about her she hath a circle very cleare.

If at the full moone in the middest of her she be cleare it sheweth a token of fayre weather, or if she be an Alborne colour or like to a rose colour it foresheweth windes, if she be blacke it foresheweth rayne.

When at her rising she rise with the upper parte of her horne blacke about, at the decreasing of the moone it will rayne, and if likewise her horne bee blacke beneath rounde about before the full moone it also foresheweth rayne.

If the moone being at the full haue a circle round about her of that parte which doth shew most bright, will the winde come.

If at the first appearing of the moone that is to say when she is new, the hornes of her doe shew great it signifieth tempest. And it shall be the greater if before the fourth day the wind do blow at the west.

If at the sirteenth day of the moone, shee seeme to bee of a great colour of flame it foresheweth tempest.

The eight Chapter of the fiers and lightes, which doe appeare in shipps that doe sayle when there is torment or tempest in the Sea.

IT happeneth to such as do sayle when there is stormes in the Sea when it seemeth that they should bee lost that all nighe they see upon the maste or yarde or in some other parte of the shippe a certaine fire or clearenesse, the which some saylers call, S. Edmund, which ought not to be so taken, seeing that it is not as they thinke, therefore I say that these fires or lightes, are a certaine impression in the ayre which the Greekes call Pili Deuces, and is so called by meanes of the grosenes of the humor which goeth from the earth and fighteth with the coldnes of the night, and so it gathereth it self togither and congealeth in the first region of the ayre, and when his exhalation findeth any body whereunto to cleaue, it kindleth and holdeth it selfe fast to it vntill it be consumed and wasted. This fire burneth not.

And Plinie in the second booke of his naturall history, the thirtie seauen chapter, saith that when these fires be two they be called Pollux and Castor

and it is a good signe, and when it is but one it is called Hellena, and it is an euill signe.

These fires are also seene in the land. And they haue beene seene in the campes vpon the pickes which the soulviers carrie, and vpon the dead bodies.

And Plinie sayth also that they haue beene seene vpon the heades of men, and of beastes, And so did Virgil affirme that it appeared vpon the head of Iulio Escanio: In the campes of the wares these fires doe appeare as well because of the continuall fumes, as also because of the heate of many people: In the shipps they ingender of the fume of the said shippe of the heate of the people gathered togeather into little rome, and of the Marriners and people in the shippe, which in the stormes with the great mouing they haue, doe ingender heate: this is when there is disposition that the rising vp of the vapour, should make impression in the ayre, as before is sayd: And Plinie sayde that one onely fire is no good signe.

This is because when there are two it seemeth that in the ayre is abundance of grosse smoke and signifieth that it is sufficient to consume the matter of the tempest.

Peter de Castroboll, vpon the second of the Metheoros saith, that whensoeuer these fires are seene in a tempest, it is a good signe, for it noteth fayre weather. Likewise it happeneth, that there are great stormes, and none of these stormes are seene, and in small stormes they see sometime one or two, so that the sailers shoulde haue no deuotion vnto these fires to beleeue that Saint Edmund is there, for it is a naturall thing.

And therefore euery one with his deuotion ought to commende himselfe to God, that he keepe them, and bring them forth of that storme, and put them in the porte of saluation.

The nienth Chapter of other certaine signes, wherein shall bee kowne when stormes will come in the sea

IN the seuenth chapter of this second booke I haue declared some signes of the sunne and the moone whereby may be knowne when stormes of wind and rayne will come, as it is declared: and because these stormes are things, that vnto such as sayle is very conuenient they should know, and preuent: it seemed well to me to adde this present chapter in the which, I will also declare other fiue signes or prognostications, which I finde written, that ought to be looked on and knowne of the saylers, which are these following.

The first is when in the high places or in the woods there is heard a noise of wind, and abroad it is not heard it signifieth stormes of wind.

The second when the waues of the sea swell and giue great falles or strokes in the bayes of the sea beeing with great noyse or rattling signifieth

ſtormes in the ſea: of theſe 2. Plinie is the author in the eighteenth booke of the naturall hiſtorie.

The thirde, if the ſea being calme, doth make a noyſe within it ſelfe ſignifieth great windes: of this ſpeaketh Virgil in the tenth of Aeneados and Lucano.

The fourth when the Porpiſſes of the ſea goe leaping vpon the ſea, and ſhew themſelues vpon the Waues is a ſigne of ſtormes, And that the winde will come from that place that they come, This Saint Iſidore bringeth in the twelfth of the Etimologias.

Of the fifth, Virgil ſaith, in the Georgians that when the Sea Meawes or Gulles doe leaue the ſea and goe to the drie lande it ſignifieth ſtormes in the Sea.

The end of the Third booke,

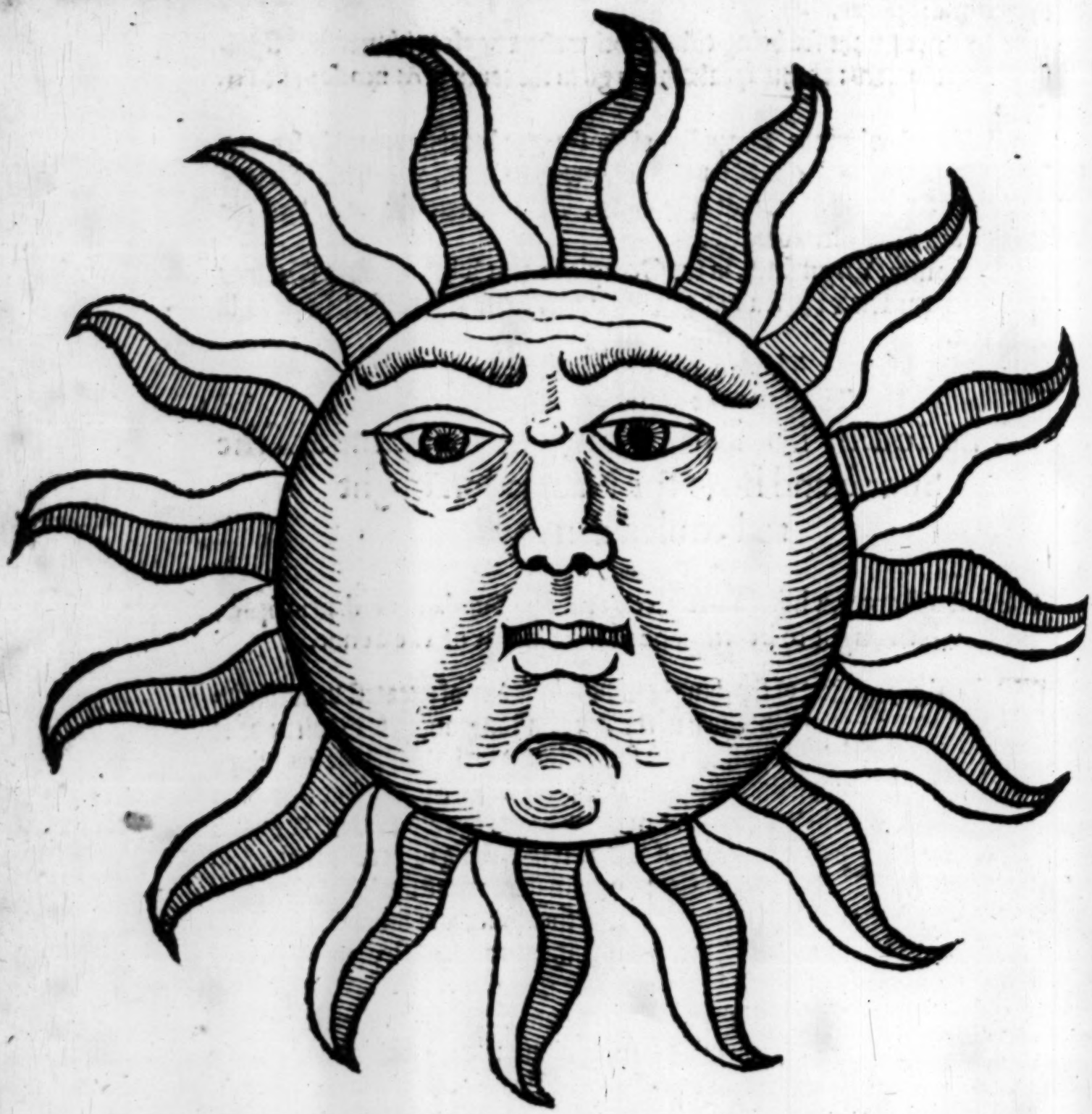
This Thirde booke muſt be read before the ſecond

The fourth booke of the height or altitude of the Sunne, and how the Nauigation ought to be ruled thereby.

The firſt Chapter, wherein are declared 17. Fundamentall principles, which ought to be knowne in the altitude of the Sunne.

ONe of the thinges moſt ſubtile and of greateſt vnderſtanding contained in the Art of Nauigation, is the altitude of the Sunne: for it ſheweth truely the way, that hee which ſayleth, maketh, or ſhall make in ſuch ſorte, that if he hath made any errour in his voyage: by this altitude he knoweth it: and ſo by reaſon it is a thing ſo excellent and ſubtile, that auncient writers in old time did highly eſteeme of the practiſe thereof, chiefly that great Ptholome, and other ſinguler authors, for the which they vſed diuers inſtruments as the Aſtrolabio, and the 3. rules, and others.

This altitude is ſo effectuall for good nauigation, that thoſe which doe ſaile to farre countries, cannot make their nauigations: if this ſhould lacke. For among all the rules and aduiſes that I haue declared in this Art, and will declare as well touching the altitude of the North as of others which ſerue in the nauigation: This altitude of the ſunne hath excellencie among all others, becauſe he is as a proofe of Arithmeticke, that ſheweth the errours which are in the numbers: ſo that by the altitude of the ſun, being preciſely taken, the Pylot may know the want or lacke that hath beene in his nauigation, And becauſe this altitude of the Sunne is a matter delicate and ſubtile



as I haue sayd. In this fourth booke, I will treat thereof as plainely as possible I can, shewing the rules by Text, and giuing them their declaration and true vnderstanding, that they ought to haue. And likewise giuing to euery one an example and demonstration that they may be better vnderstood,

and

and for this ſhall bee noted 17. fundamentall beginninges, which are theſe following.

Altitude.
Degree.
Horizon.
Zodiacke.
Equinoctiall line.
Declination.
Circles.
Tropikes.
Part of the North.
Part of the South.
Longitude.
Latitude.
Parelius.
Meridian.
Hemiſphera.
Zenith.
Centrum.

Altitude is the degrees which the ſunne or the pole doe rayſe themſelues aboue the Horizon. Likewiſe an altitude is underſtood by thoſe degrees, that anie Citie, Port, Iland, &c. are diſtant from the Equinoctiall line. A degree is one part of three hundreth and ſixtie: wherein the world is deuided, it hath ſeuenteene leagues and a halfe of way, by the longitude which is the length or breadth of the water and earth.

Horizon is a circle which we doe imagine vpon the vppermoſt part of the earth: in the which our ſight is fired, which is as farre as our ſight can reach, and by this circle halfe the heauen is deuided which we ſee, from the other halfe which we ſee not.

Zodiacke is a circle really ſcituated in the eight heauen, vnder the which the ſunne moueth it ſelfe in all the yeere. This Zodiake deuideth the Equinoctiall line, into two equall partes: the one from the Equinoctiall line by the part of the North, and the other by the part of the South, by euery part of theſe it hath 180. degrees, ſo that the Zodiacke hath 360 degrees.

The Equinoctiall is a ſtreke or circle imagined by the halfe of the world from the Eaſt into the Weſt in equal diſtance from both the poles, ſo that from the Equinoctiall vnto euery one of the poles are ninetie degrees. It is called Equinoctiall, becauſe the ſunne paſſing by it cauſeth Equinoctio, which is as much to ſay, the day and the night to be equall.

Declination is the diſtance which the ſunne by his owne mouing maketh from the Equinoctiall line, 6. monthes of the yeere to the north parte, and 6.

monthes

monethes to the South part.

Circles are the way whereby the poles of the Zodiacke doe moue in roundnesse from the poles of the world. These doe take their names of the saide poles: and so they are called circle Articke, and circle Antarticke, these circles are distant of the said poles of the world, 23. degrees, and 33. minutes.

Tropicos or Tropikes are 2. cirtles where the sunne last of all doth come once in a yeere. One vnto the part of the North, and the other vnto the parte of the South. It is called the Tropicke of Tropos which is a Greeke name, and is as much to say as conuersion, for the sunne being come to euery one of these Tropikes conuerteth her selfe and turneth backe.

The parte of the North is taken for halfe the worlde, which is from the Equinoctiall line vnto the Pole Articke.

The parte of the South is the other halfe of the roundnesse of the worlde, which is from the Equinoctiall line vnto the pole Antarticke.

Longitude or length, is vnderstood by the way from the East into the West, or from the west into the East, for that this is the length of the world.

Latitude or breath is the way which is taken from ỹ North to the South, which is from one Pole to the other, for this is the breath of the world.

Parelius is a way imagined to goe straigth by the heauen, or by the Sea, or by the land, from the East into the West, or from the West into the East, without comming neere to the Equinoctiall line, or to the poles more in one part then in another.

The Meridian is a line, which is imagined from one pole of the world to the other, right ouer our heades, and when the sunne commeth to this line, it is the middest of the day vnto such as inhabite vnder it.

Hemisphera is as much to say, the halfe sphere: and it is to be vnderstood, that all the world is one Sphera Esphera, and is taken for a round thing, and because the world is round, it is called Sphera, and seeing that in what place soeuer a man is, her seeth the halfe of Heauen: This halfe of the Heauen, which we se, we call Hemisphera.

Zenith is a point imagined in the heauen very precisely put ouer our head, and from this point or Zenith to any manner of place of our Horizon are 90. degrees.

Center is a point in the middest of the sphere imagined, and so in the middest that from it to the superficie, all the lines that from forth right shall be layd, shalbe equall: and from any part of the superficie to this point is to descend, and from it to the superficie is to rise vp.

The second Chapter, of the excellencies of the sun, and of his mouings:

SAint Ambrose saith, in the Exameron, that the sunne is the fountaine of light, the faireuesse of ỹ day, the ornament of heauen, the measure of time, the vertue and strength of all thinges which are borne, and according as the

Philosopher

Phylolopher ſaith, is cauſe of all generation and corruption. It is of a verie great quantie, ſo much that Ptholomie ſaith in ꝑ Almageſto ⁊ Alfragano, in the difference 22. that the ſunne is an hundreth ſirtie and ſixe time greater then the earth, his mooving is more ſwift then any arrow, and we doe not ſee him moue by reaſon of his great brightneſſe which is of more ſtrength to be ſeene, then our ſight can ſee: And to our iudgement he goeth by leaſure. But the quantitie of the way being knowen which he goeth, his lightneſſe is innumerable: ſo that for the great diſtance that is from vs to him, we cannot determine his mooving. And it is to be noted, that the ſunne hath two movings contrarie, which are one forcible, and the other proper: the forcible moving is it that wee ſee that euerie day hee maketh a forcible going by the firſt moueable, and in euerie 24. houres, hee goeth round about the world from the Eaſt into the Weſt. The other mooving which is naturall, and proper to himſelf, worketh contrary to the firſt, that is to be vnderſtood from the Weſt into the Eaſt, in his circle Excentrico: the which moving, he maketh in three hundreth ſirtie and fiue dayes and ſixe houres, and leſſe a little quantitie: And this moving he maketh in this maner, from the eleuenth day of March, that the ſun paſſeth by the line Equinoctiall vntill the eleuenth day of June, the ſunne goeth riſing vp, by the parte of the North, and ſo putting himſelfe from the ſayd line, the eleuenth day of June, he commeth to the tropicke of Cancer, and in this riſing vp that he maketh theſe three months he departeth from ꝑ ſayd line twenty three degrees and thirty three minutes: which is his greateſt declination, or diſtance that he maketh from the ſaid line, and from the twelfthe of June, vnto the thirteenth of September, the ſunne deſcendeth from the ſayd Tropike vnto the line: and from the fourteenth of September, vnto the thirteenth of December: the ſun deſcendeth by the part of the ſouth from the line to the tropike of Capricorne, from whence he departeth other twenty three degrees, and thirtie three munites, which is likewiſe his greateſt declination of that part: and from the fourteenth of December, vnto the teenth of Marche, the ſunne goeth riſing from the Tropike of Capricorne vnto the line: ſo that of the twelf monthes of the yeere, ſixe of them, the ſunne goeth from the line to the parte the North, and the other ſixe to the parte of the South. And all the mooving which the ſunne maketh, is from one Tropike to another: in the which are 47. degrees, and 6. minutes. This is the latitude of the Zona, which the ancient Writers called Torrida, which is as much to ſay, toſted, becauſe alwaies the ſunne maketh his moving by her within theſe Tropikes, without going forth of them at any time.

And it is to be vnderſtood, that the time which the ſunne goeth towarde the parte of the North, and the time he goeth toward the parte of the South, is not equall, for the ſunne goeth toward the parte of the North, a hundreth eightie and ſeuen daies, and he goeth towardes the part of the South, a hun-

dreth

yeth sixtie and eight: where it appeareth that the sunne goeth more time of the yeere vnto the part of the North, then vnto the part of the South. The cause is, because this circle Excentrico: wherein the sunne maketh his moving, is so shut into the Sphera, that of one parte hee commeth more neere to the firmament, then of the other, for the which cause hee is described forth of the Center of the worlde.

The part of this circle that commeth more neere to the firmament, is called Auxe, which is as much to say, eleuation, and this is when he commeth to the tropike of Cancer, and that when he is most distant is called opposite of Auxe, and this is when he commeth to the tropike of Capricorne: so that when the sunne is in his Auxe, hee is more neere to the firmament, and when he is in his opposite, he is more neere to the earth, in such sorte that in the Sommer the Sunne goeth farre from the earth, and in the Winter, is more neere to the earth. This is to bee vnderstoode in respect of vs in the Winter, and in respect of such as inhabite towardes the parte of the South in Sommer. The cardinall Peter de Alico proueth, that aforesaide in the twelfth question, in the first article of the seconde notable, where hee sayeth that the sunne maketh his mooving, being come to the ende of Gemini is in the Auxe: of his Excentrico, and in the end of Sagitarius is in the opposite.

This seemeth by the demonstration that Ptholomie putteth in the thirde distinction of the Almagesto. And seeing that the Center of the Excentrico, of the sunne is distant from the Center of the worlde, by so much when the sunne in his Auxe is more distant from the earth: and when he is in the opposite, he is more neere to it. And so it is proued that the sunne is more neere to the earth in our Winter, then in Sommer.

The third Chapter, of the yeere called Solar, and other maner of yeeres, and how the leape yeere is reckoned.

The yeere Solar is the time, wherein the sunne passeth the twelue signes of the Zodiacke, and returneth where hee began. It is called a yeere, which is as if one should say, a ring, or circle, because the sunne hath gone his circle, he returneth to the same place where he began.

The Egyptians as S Isidore saith, before they had the knowledge of learning, they accustomed to figure the yeere in a drogon, that bitt the taile, but since they had learning and account of the yere, they began it in September, because they say, that in that moneth the worlde was made. And the Arabians begin in ỳ same time, the Hebrus begin in the moneth of march, because it was giuen to them by law, we begin it in Januarie, because then did our true yeere begin, which was the birth of the sonne of Iustice, Christ our God. And because the sunne doth begin to came neere vs, In the scripture I finde fiue sortes of yeares. Anno Solar, Anno Lunar, Anno Emergente, Anno Grande, Anno Mundano. The yeere Solar is it that before hath beene de-

delar.

clared. The yeere Lunar is the tyme which doth containe twelue moneths, of twentie nine daies, and a halfe, which amounteth to three hundred fiftie four vnto the which is added the eleuen dayes of the concurrent, because the yeere Lunar which is of the moone may come with the Solar which is of the Sun. The yeere Emergente is when there happeneth a thing very notable, and in the time following is speech therof, euen as they talked in the time of Cæsar, and now of the birth of our Lord Iesus Christ. Anno Grande is as much to say, as a great yeere, according as the master of the histories saith, that it is a time of fiue hundreth yeeres. Anno Mundano according to Macrobio, is when the Starres and all the Planits will come to the point of our degree where they began their first mouing. And this he sayth shalbe in fifteene 1000 yeeres, likewise the other saith that it will come in fortie and nine thousand yeeres. But any manner of thing that the Philosopher speaketh of in this matter, is according to his owne oppinion, wee ought to holde that the time and the mooning of the things and the ende of them is in the hand of him that made them of nothing, and vnto men doth not appertaine to iudge nor determine of the time or ending of the world. For the most high prouidence of the father eternall did put it in his owne bosome, as our redemer Iesus Christ teacheth vs, answering to such as asked him the saide question, as it is written in the Actes of the Apostles the first chapter. Therfore I say that the yere called Solar hath three hundred sixtie fiue dayes, and fiue houres lacking twelue minutes giuing to euery houre sixtie minutes, and because in the yere are accounted fiue whole houres of this hath come, although the quantitie be little, that it is no more but one fifth part of an houre in euery one yere, in so many number of yeeres they haue not made eleuen dayes of difference in the time, so that these fiue hours which are accolited in the yere besides these said daies from foure to foure yeeres doth amount to twenty foure houres which maketh a naturall day, and so this fourth yeere hath three hundreth sixtie sixe dayes and this is called leape yeere, it is also called Bissiesto by the minutes which are called Bises the which minutes the Sunne tarrieth in euery one signe more then the thirty daies. Bissiesto is as much to say two times sixe, for because the yeere of Bissiesto, the day that is sixe dayes before the Kalendes of March is reckoned twise, so that in one onely letter of the Kalender there are two dayes which are the twentie foure and the twentie fiue of February, that is to say the day that serueth the sayd letter, and more the day that is encreased by the Bissiesto or leape yere by the which the leape yeere in the moneth of Februarie hath twenty nine dayes and the other yeeres twenty eight.

Therefore it is to bee seene, when the altitude of the sunne is taken to knowe his declination if it bee a leape yeere, or the first, the seconde, or the thirde after the leape yeere as is plainely to bee found in the seuenteene chapter, which treateth of the declination, and according to the yeere, so must the

declination

declination of the Sunne be sought for.

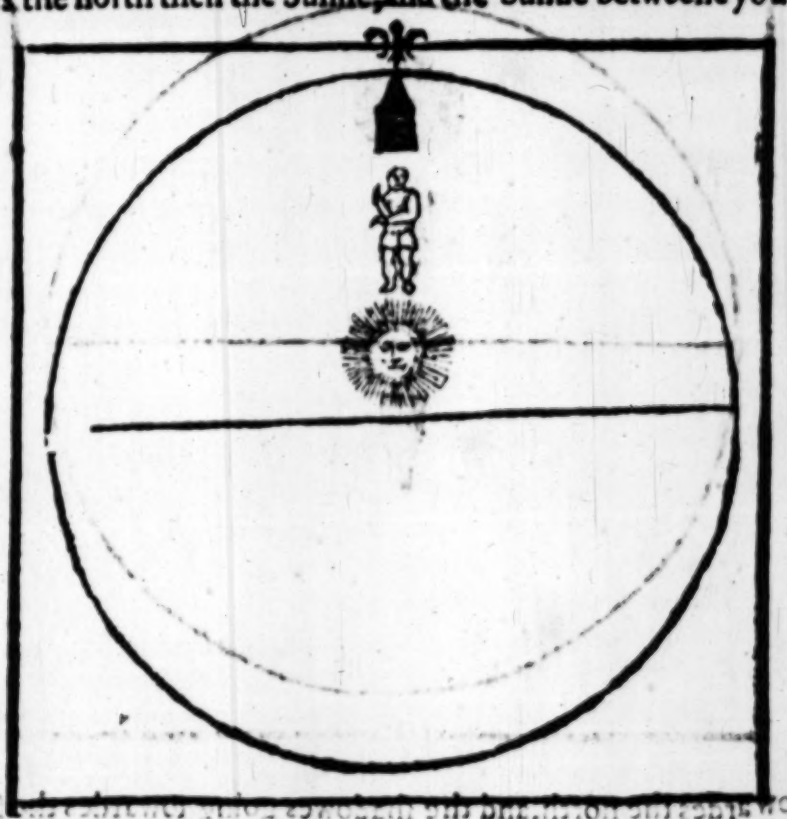
Tho fourth Chapter, what thing a shadowe is, and how the shadowe which the sunne maketh ought to be looked on, for to take his altitude.

The shadowes are caused when any darke body is opposite to the light, and so the shadow hath an apparance or shew of a body, and it is none. The shadow fleeth away from such as follow it, and followeth such as flee from it. The shadow by how much the sunne is higher, by so much it is lesser, and how much the lower, the greater: whereby the shadow of a man is greater in the morning and in the euening, then at the middest of the day, and it is to be noted, that the sunne goeth alwaies in one of these three places, which is towarde the part of the North, or in the Equinoctiall, or towardes the part of the South: and in these three partes to such as inhabite in the world it maketh fiue shadowes: (That is to say,) a shadowe at the East, a shadowe at the West, a shadow at the North, a shadowe at the South, and a straight shadow. The shadow at the East, is when the sunne doth set. The shadow at the West is when the sunne riseth.

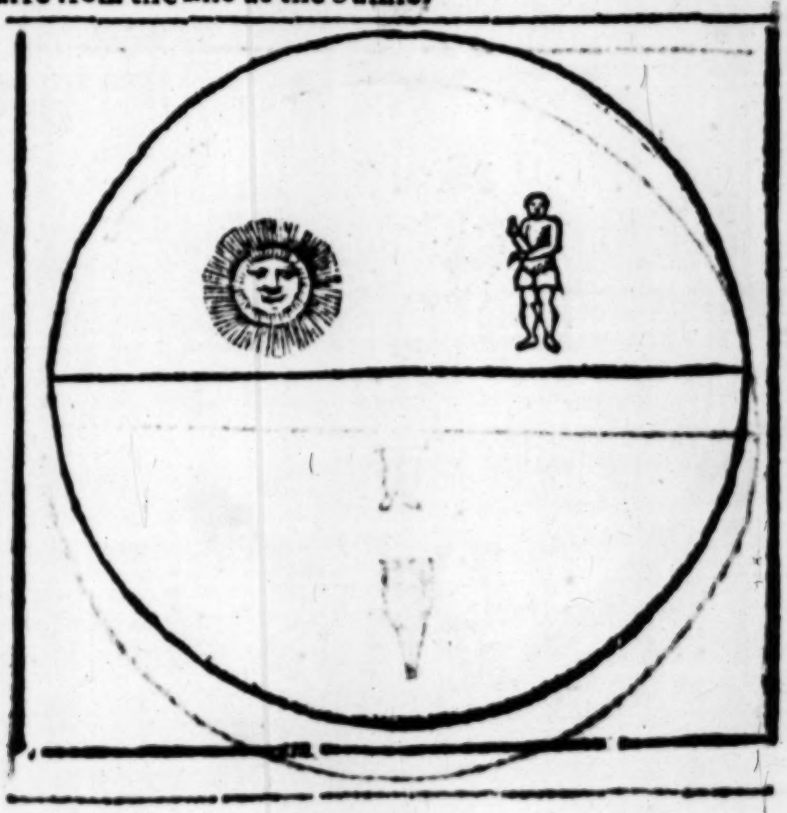
The shadowe at North is when the sunne commeth to the midst of the day, and he that maketh the shadow is more towards the North then the sun. And the shadow at South is when hee that maketh the shadowe is more towardes the South then the sunne: there is likewise a straight shadow, when the sunne is in our Zenith. All these shadowes, such as dwell within the Tropikes haue. Those which inhabite vnder the Tropikes, haue foure shadowes, (that is to say) shadow at East, shadow at West: and those of the tropike of Cancer, haue the shadowe at North: and those of the Tropike of Capricorne haue the shadowe at South: and once in the yeere a straight shadow, which is when ỹ sun entreth into that tropike. Such as dwell without the Tropikes haue three shadowes, at East, and at West, and those of the parte of the North, haue shadow at North, and those of the parte of the South, haue shadow at South, and neuer any straight shadowe. But do you note, that although the sunne doth make in the yeere fiue shadowes to such as dwell in the world not onely in fiue partes, but in xiii. differences of parts, you may be with the sunne and haue xiii. differences of shadowes, and no more, (that is to say) fiue when the sunne goeth towardes the parte of the North, and three when he is in the line, and fiue when he is towades the part of the South, the which by xiii. rules with their demonstrations shalbe noted in this manner.

When the Sunne is towardes the North.

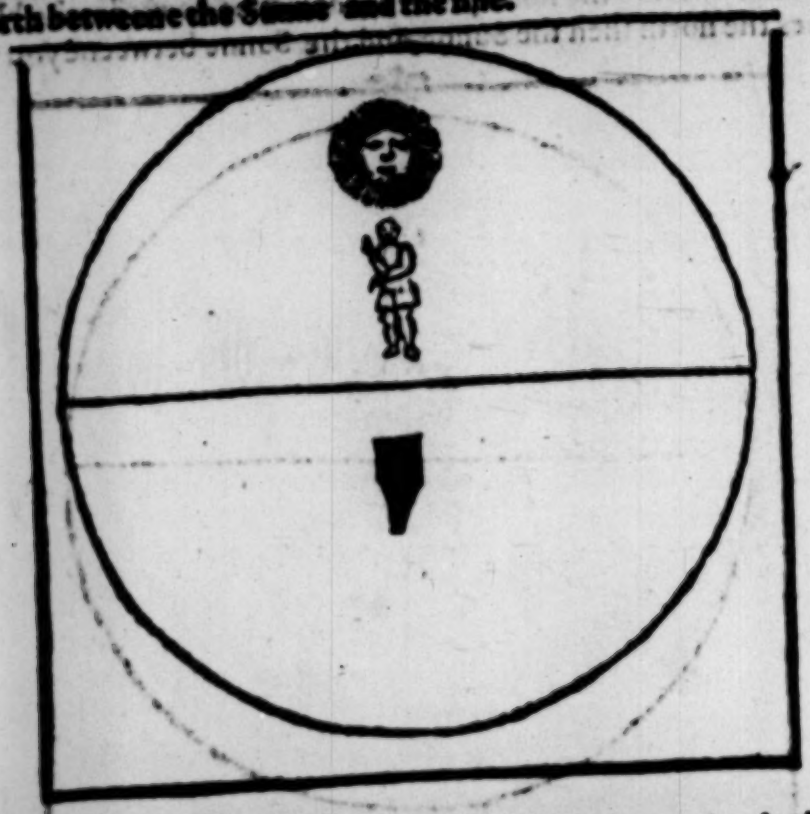
The Sunne being towardes the north, if the ſhadowes be towardes the North, you are more towardes the north then the Sunne, and the Sunne betweene you and the line.



The Sunne towardes the north, if the ſhadowes be to no parte, then are you towardes the north as farre from the line as the Sunne.



The Sunne towardes the north, if the shadowes be towardes the south, you may be towardes the north betweene the Sunne and the line.



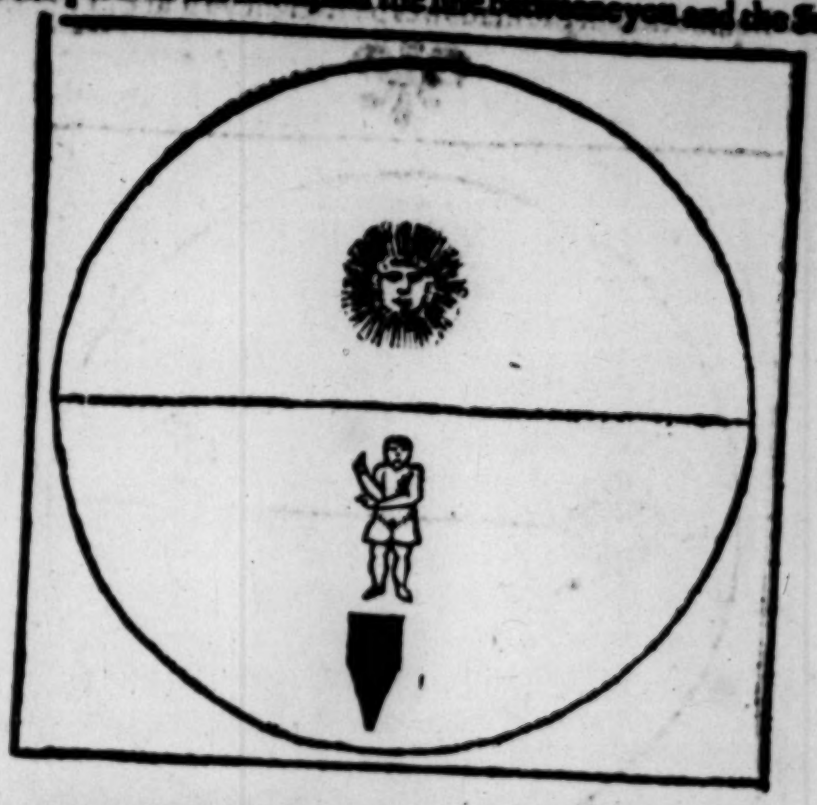
The Sunne towardes the north, and the shadowes going towardes the south you may be in the Equinoctiall line.



The

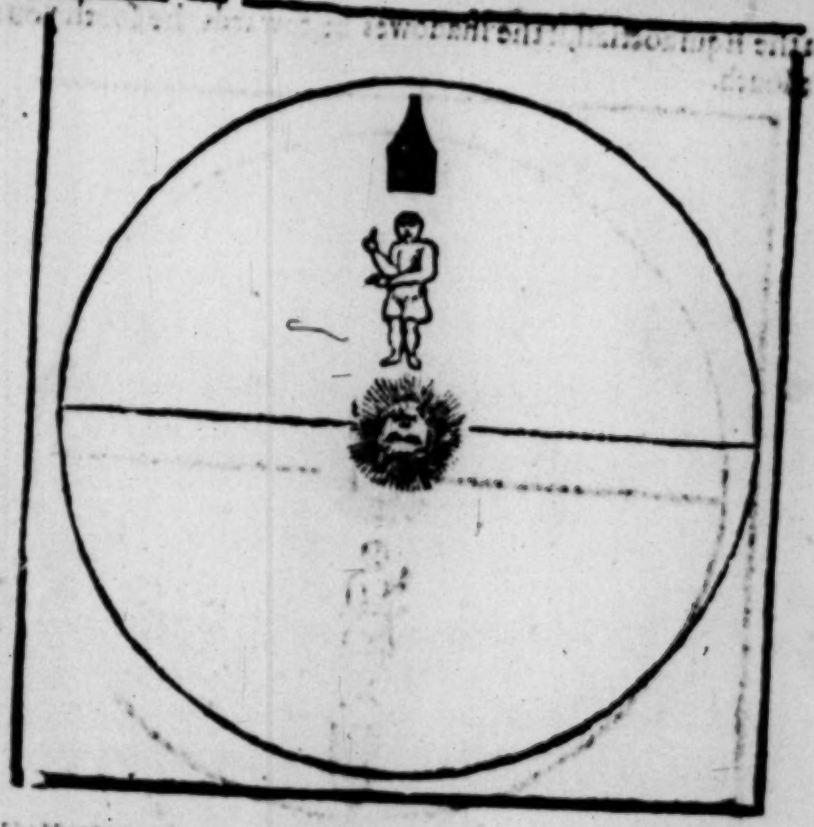
of the shoulde of the Sunne.

The Sunne towardes the North, and the shadowes going towardes the south you may be towardes the parte of the south, and the line betweene you and the Sunne.

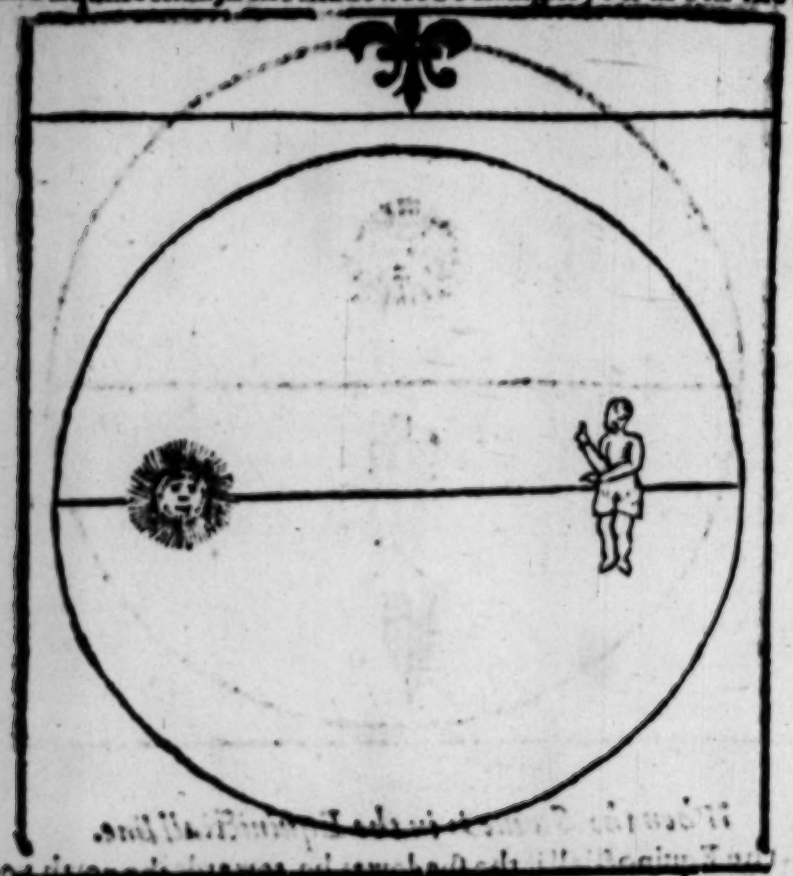


When the Sunne is in the Equinoctiall line.

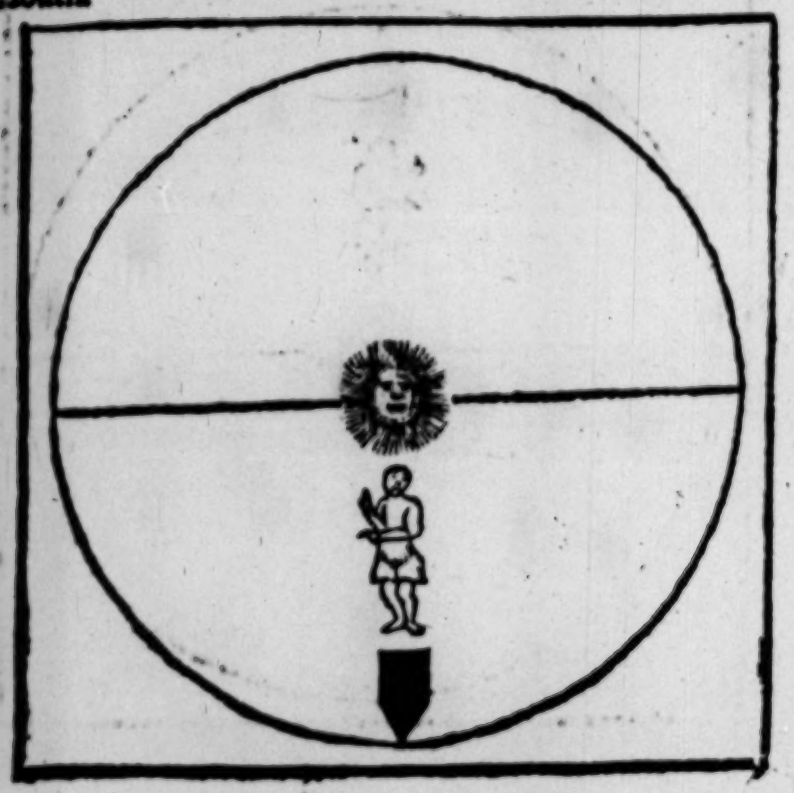
The Sunne in the Equinoctiall if the shadowes be towards the north, you are towards the part of the north.



The Sunne in the Equinoctiall, if the ſhadowes be ſtraight you are in the Equinoctiall

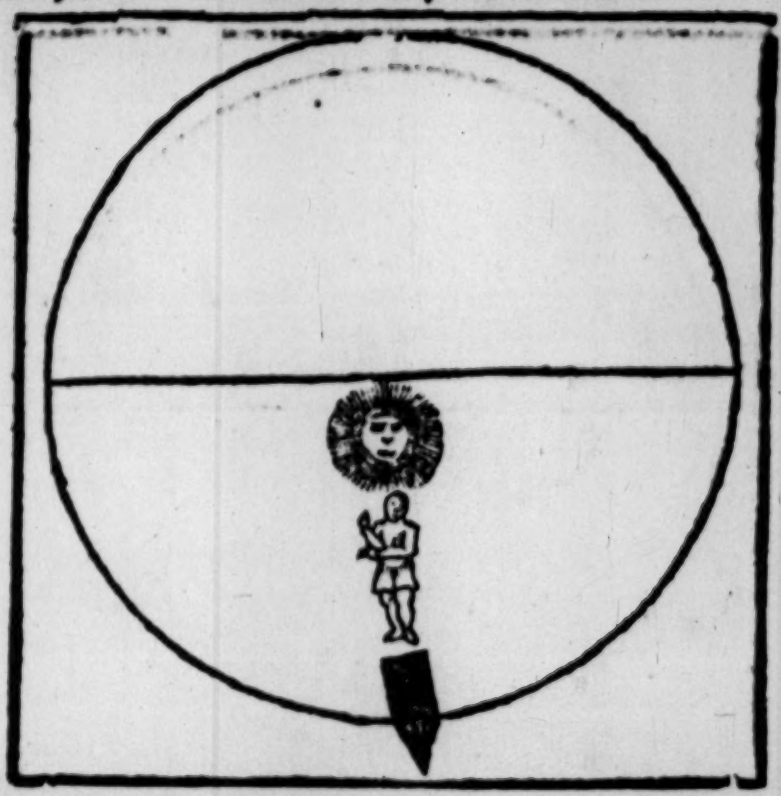


The Sunne in the Equinoctiall, if the ſhadowes be towards the ſouth you are towards the part of the ſouth.

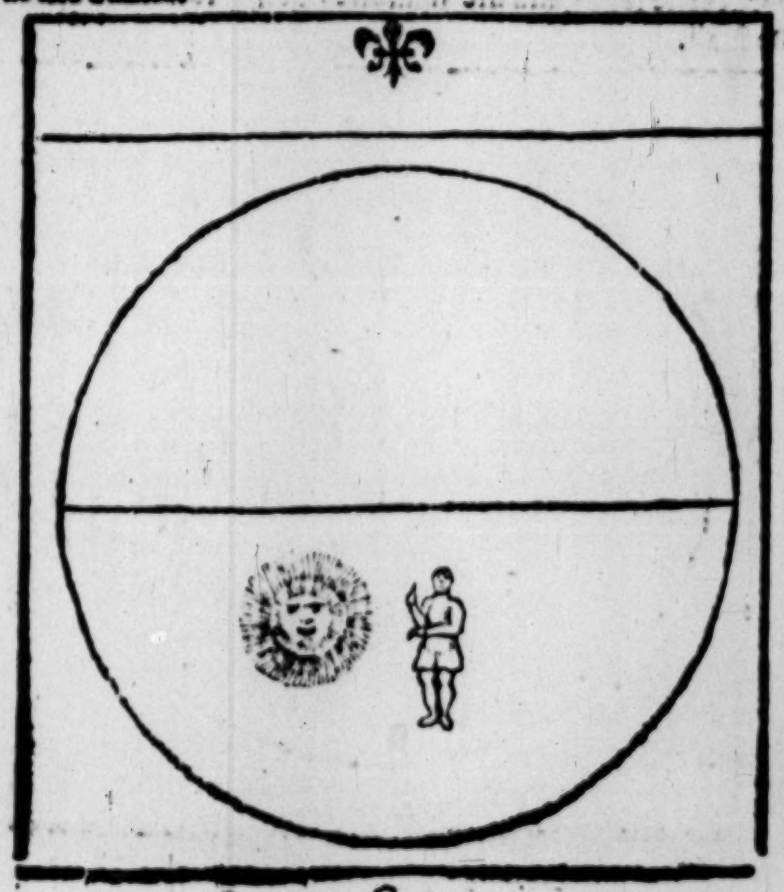


When the Sunne is towardes the South.

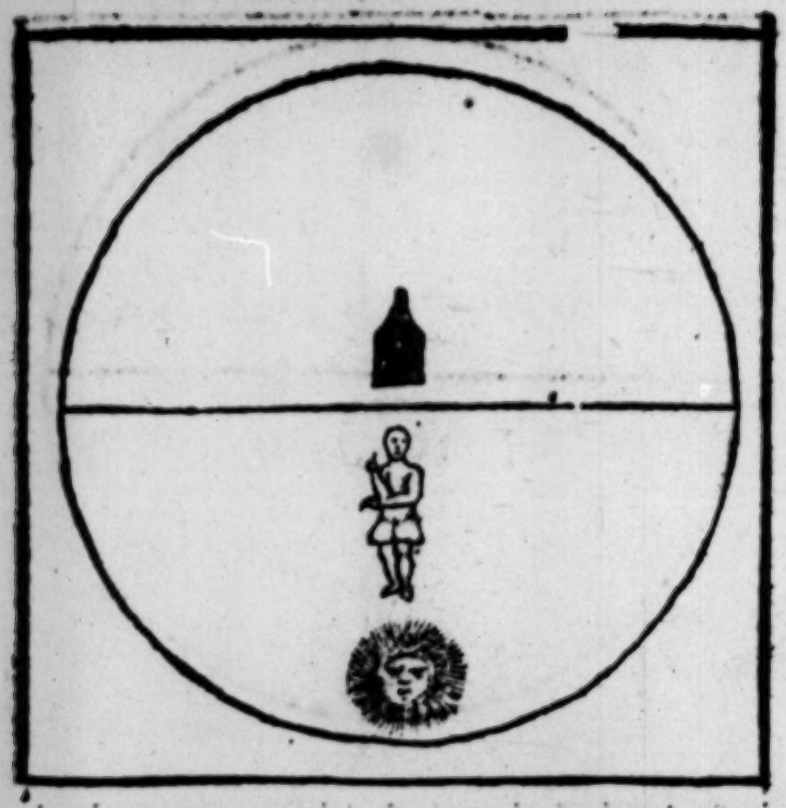
The Sunne towardes the ſouth, if the ſhadowes bee towardes the South you are towardes the South, and the Sunne is betweene you and the line.



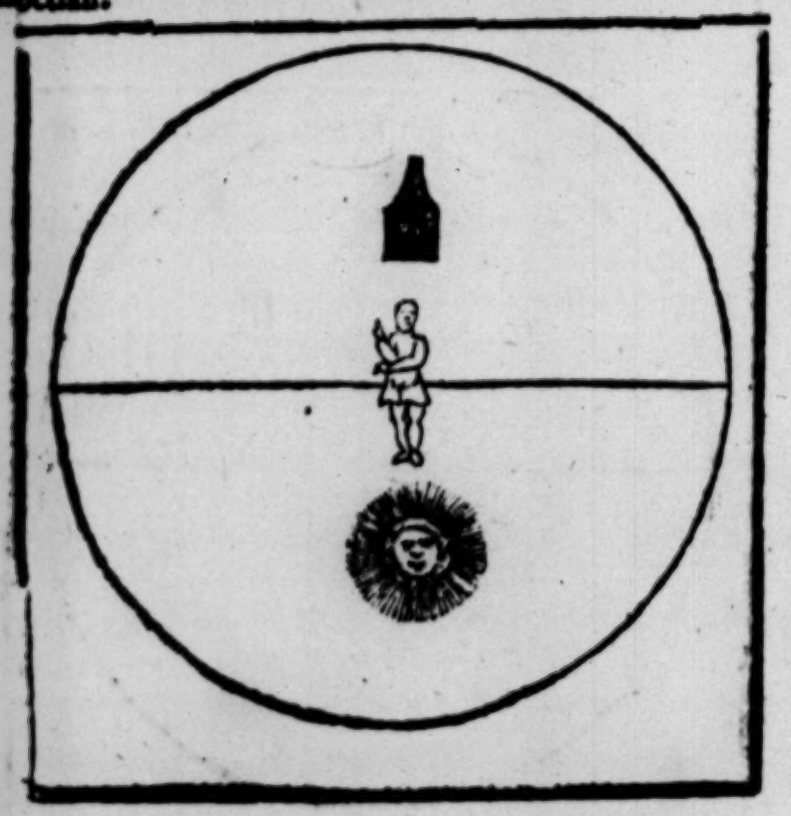
The Sunne at the ſouth if the ſhadowes be ſtraight you are towardes the ſouth as farre from the line as the Sunne.



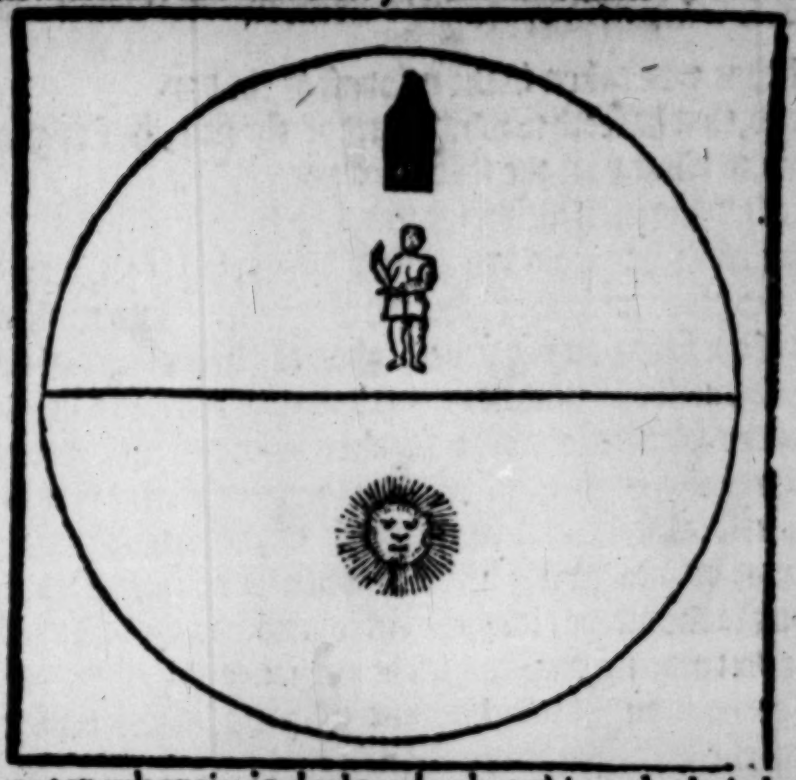
The Sunne at South if the shadowes bee towardes the north you may be towardes the South betweene the Sunne and the line.



The Sunne towardes the South, and the shadowes going towardes the north yet may be in the Equinoctiall.



The Sunne towardes the south, and the shadowes towardes the north, you may be towardes the north and the line betweene you and the Sunne.



The fifth Chapter, wherein is declared what thing the height of the Sun is, and how it ought to be taken to know the place where a man is.

SEeing there hath beene declared the difference of shadowes which the Sunne maketh, or may make by all the yeere in any manner of place that a man is, the which shadowes are necessarie to be known. For to know precisely how to take the altitude of the sunne, I will speake, what thing the altitude of the sunne is, and the manner that must be had, for to take it well. For this is to be noted, that Ptholomie saieth in the first of Geographia, that whersoeuer a man is, hee seeth halfe the heauen, and the other halfe is hid from him, in such sorte that of three hundred and sixtie degrees that the heauen hath in roundnes wee alwaies see the hundred and foure score which is the halfe wherein is contained our Hemisspherio, so that whersoeuer a man is, and in any manner of time, from his head or Cenith, vnto the Horizon are ninety degrees, and so from what place a man is in euen vnto the sunne, when he riseth in the morning, that hee doe beginne to appeare in the Horizon are ninetie degrees, and how much more the day goeth forwarde, and the sunne goeth rising, so much more he commeth neerer towards our Cenith. And this rising vp that ỹ sun maketh, is called the altitude of the sun, because he goeth rising, and going vp vpon the Horizon, the which altitude he that shall take him at the middest of the day, let him vnderstande that the degrees that hee shall finde in his Astrolabio, lesse then ninety, those shoulde bee from him to the sunne for that the sunne shalbe so many distant from his Cenith, which is from the right of his head. Therefore I say to know the altitude that the

sunne hath euery day vpon the Horizon which the Pylot or any other person that would take it, ought, first of all to looke on fiue thinges which are these following.

The first, that it be taken in the middest of the day.

The second, that he seeth to which part of the line, the sun goeth that day.

The third, to what part the shadowes goe.

The fourth, what declination the sunne hath.

The fifth, that he know how to apply the rule that is conuenient according to the time and place wherein he findeth him selfe. Unto the first I say, that the altitude of the sunne ought to bee taken at the middest of the day iustly, this is because vntill the sunne commeth to the Meridian he goeth alwayes rising aboue the Horizon, and if he be taken before or after hee will not bee so iustly taken, but although that in this be some difference of time being but a little thing, before or after, it is no great inconuenience, because the most times it cannot be punctually knowne when he commeth to the Meridian. Although you looke on the cloke, the Astrolabio, or any other instrument, but alwaies doe you procure to take him at the houre aforesaid.

To the second, it ought to be seene at what parte of the line, the sunne goeth, if it be at the North or at the South, considering that the time, which the sunne goeth toward the part of the North, is from the eleuenth of March vnto the thirteenth of September, and from the fourteenth of September vnto the tenth of March he goeth to the part of the South.

Unto the thirde, he that taketh the altitude ought to see to what parte the shadowes are from him, (that is to say) the shadow of his person, or of the mast of his shippe, or of any other thing that is put vpright. And so by the shadow he shall know at which part of the line he is, for being knowne to which part the sunne goeth, it may be easily knowne by the said shadow, towardes what parte he is of, as in the fourth Chapter hath beene declared.

To the fourth, the yeere ought to bee looked vnto, if it be a leape yeere, or the first, the seconde, or third yeere after the leape yeere, and according as the yeere is, let him looke on the moneth, and day wherein he is: and what declination the sunne hath towardes the parte where he goeth, that is howe many degrees and minutes he is distant from the sayd line.

To the fifth, that he apply euery rule of the altitude in his proper time and place, and this the Pylot ought alwaies to procure and knowe the rules of the altitude, not onely the wordes but the meaning of them, for he that onely knoweth rule, and doth not attaine to the reason or foundation thereof, as it ought to be vnderstoode, it procureth to him many harmes, and hee knoweth not of what they proceed, and finding himselfe in the errour he putteth faulte in the instruments and rules, the fault being in himselfe, because hee vnderstandeth them not.

And

And becauſe theſe rules of the altitude of the ſunne may be well vnderſtood, and that there ſhould be no ignorance in any thing, here ſhall be put euery one with his declaration, figure, and example, in manner following.

The firſt rule, when the Sunne goeth towarde the parte of the north, and the ſhadowes goe towardes the north.

THe Sunne towardes the parte of the North, if the ſhadowes be towardes the North you are towards the North, and the Sunne is betweene you and the line, ſee how many degrees you tooke of altitude and how many doth lacke of ninety, and with thoſe that lacke, ioyne the declination of that day, and al ioyned together you are ſo much diſtant from the liue towardes the North.

This firſt rule doth ſhew how you ſhall know the altitude of the Sunne, when he goeth towardes the north, and hee that taketh the altitude is more towardes the north then the ſunne, and ſo he ſaith.

The Sunne towardes the parte of the North, is as much to ſay, that when you do take the altitude of the Sunne in any day of the fire monethes, that he goeth from the line vnto the part of the north.

If the ſhadowes be towardes the North, if in this day that you take the altitude of the ſunne the ſhadowes be from you towardes the North.

You are towards the North and the ſunne is betweene you and the line, in ſuch ſorte that by the ſhadowes you doe know that the Sunne is betweene you and the line, at ſuch time as when they are in this manner.

Behold how many degrees you take of altitude, theſe degrees are thoſe that you take the Sunne in your Aſtrolabio, therefore looke on theſe degrees how many they are.

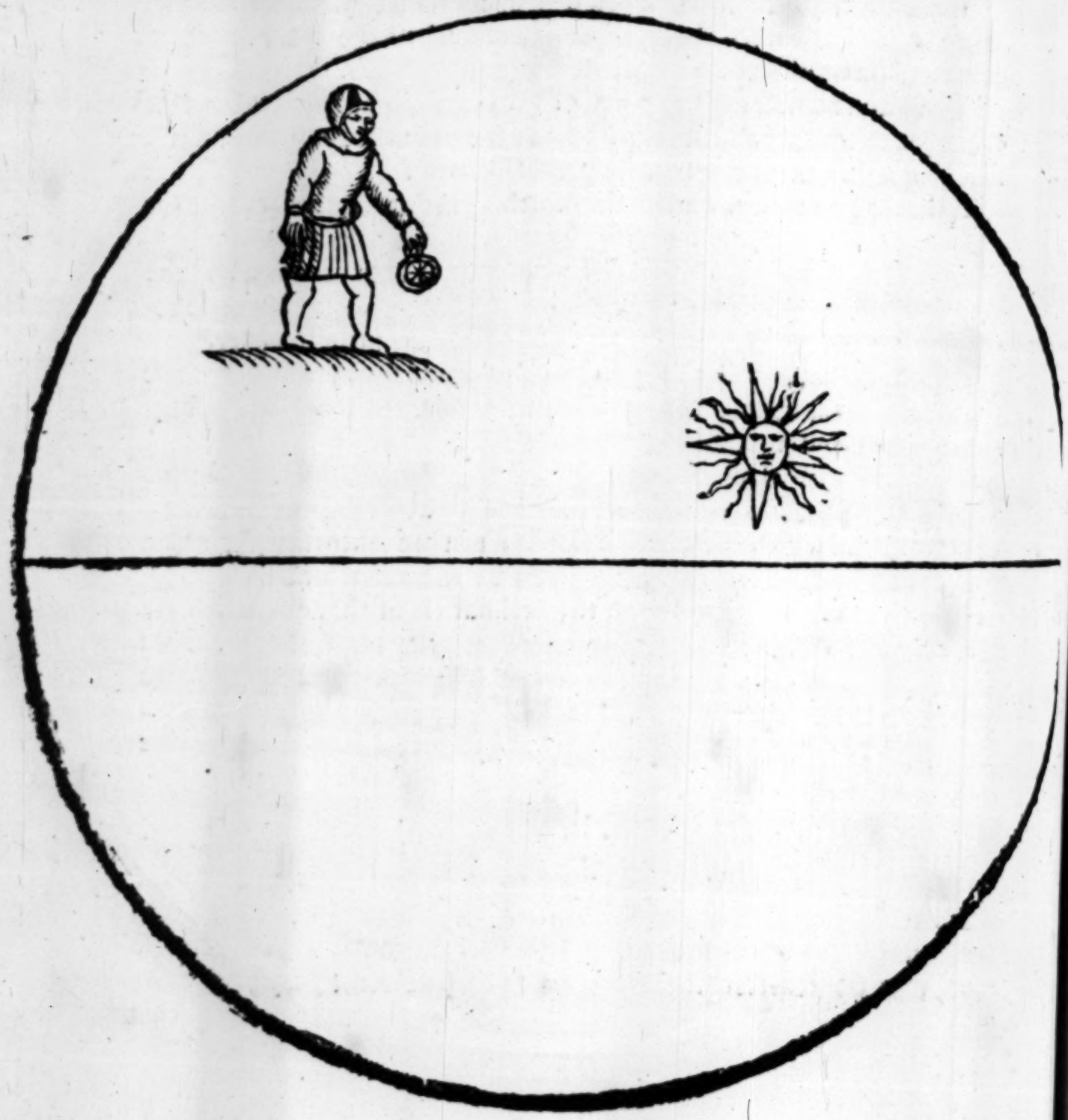
And how many lacketh for ninetie, is to be vnderſtood vpon thoſe that you found of Aſtrolabio, looke how many they are, which do lacke for to come to ninety, And with thoſe which lacke, as if you had taken fiftie, there lack fortie: and if you had taken 65. there lacke 25. Therefore with thoſe fortie. or twentie, or more or leſſe, Ioyne the declination of that day, which are thoſe degrees and minutes which the ſunne is diſtant from the line, as you ſhall find in the declination of the ſayd day, And all put together that is to ſay, the declination of the ſunne, and the degrees which lacke for ninetie, and that which this ſhall ſumme or amount vnto, you are diſtant from the line towardes the North.

An example.

The ſixte day of April, I taking the altitude of the ſunne, the ſhadowes were from me towards the North, and I tooke the ſunne in ſixtie degrees of Aſtrolabio, there lacked 30. for 90. with theſe 30. I ioyned 10. degrees which the ſunne had this day of declination, which did amount to fortye degrees, ſo much was I diſtant from the line towardes the part of the North. The rea-

ſon is, for becauſe in the moneth of Aprill, the ſunne goeth towardes the parte of the North, and as the ſhadowes were from mee towardes the North, I knew that I was more towardes the North, then the ſunne, therefore the ſun being taken in the ſixtie degrees, the thirtie which lacked for ninety, was I diſtant of the ſunne.

This is becauſe alwaies, when that I ſhall take the altitude of the ſunne, thoſe degrees that I ſhall find in my Aſtrolabio, leſſe then ninety, the ſelf ſame am I diſtant from the ſunne, and the ſame day, the ſunne was diſtant from the line ten degrees, which was his declination, ſo that from me to the ſunne, were thirty degrees, and from the ſunne to the line, ten which maketh fortie: ſo much was I diſtant from the ſaid line. The



The ſecond rule, that when the ſun is towardes the North, and the ſhadowe towatdes the South, the declination and altitude are more then ninety degrees.

IF the ſunne be towardes the North, and the ſhadowes bee towardes the South, ioyne the declaration with the altitude, and if the paſſe ninetie degrees, thoſe which are more, you are diſtant from the line towardes the North, and you are betweene the Sunne and the line.

In the firſt rule hath beene declared that when the ſunne is towardes the parte of the North, and he that taketh the altitude is more towards the north then the ſunne whereby the ſhadowes goe from him towardes the North. This rule is, when the Sunne goeth towarde the ſelfe ſame parte of the North, and he which taketh the altitude, the ſhadowes goe from him towards the South in this manner. The Sunne towardes the North, the time which the ſunne goeth towardes the North, hath beene declared. Therefore in this time, If the ſhadowes be towardes the South, the South ioyneth the declination with the altitude, which is as much to ſay, looke on the degrees and minutes that this day hath of declination, and ioyne them with the degrees, that you may take the ſunne in your Aſtrolabio, and if they doe paſſe ninety degrees, if altogether the declination of the ſunne, and the altitude which you tooke, were more then ninetie degrees.

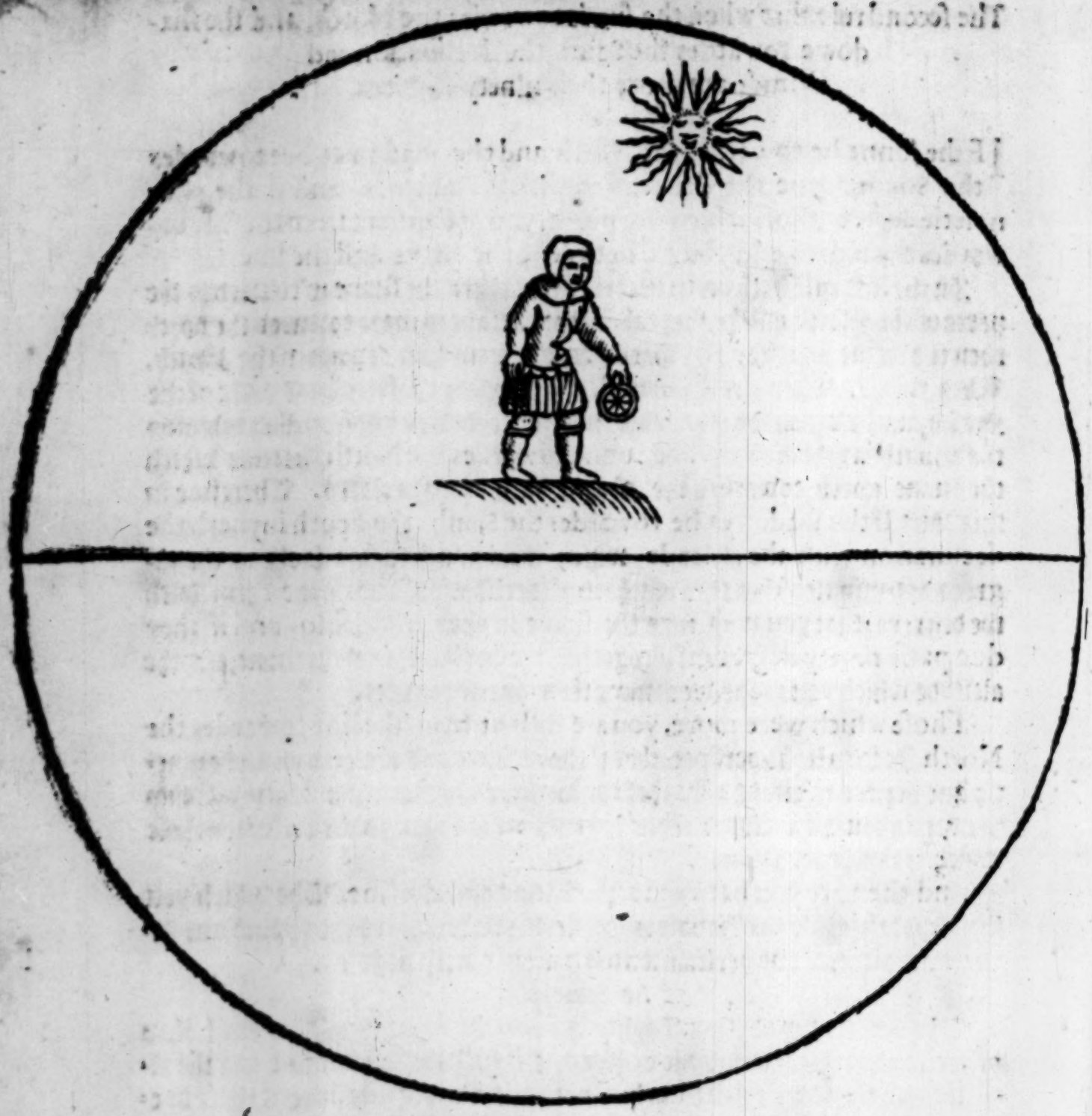
Thoſe which were more, you are diſtant from the line towardes the North. It is to be vnderſtood, that if the altitude and declination were ninetie fiue degrees, you are diſtant of the line, fiue degrees: and if they were an hundreth, you were diſtant tenne degrees: and ſo are to bee reckoned thoſe which are more then ninety.

And then are you betweene the Sunne and the line. The which you ſhall know becauſe the ſhadowes goe from you towardes the South, and becauſe the altitude and declination did paſſe of ninety degrees.

An Example.

The twenty day of May, I toke the ſunne in 80 degrees, this day he had of declination twentie and one degrees, I ioyned the declination and the altitude, and they amounted to an hundreth and one degrees, ſo that there be eleuen degrees more then ninety. Theſe eleuen was I diſtant from the line towards the North, betweene the ſunne and the line, the reaſon is, becauſe this day the ſunne was diſtant of the line 21. degrees: which was his declination towardes the parte of the North: ſo that I hauing taken the ſunne in foureſcore degrees, there was from me to the ſunne, ten degrees, and as I am betweene the ſunne and the line, I being tenne degrees diſtant from the ſunne towards the line, there was from me to the line eleuen degrees, which lacketh for the twentie one, which is the declination of the ſunne.

The



The third rule, when the ſunne is towards the North, and the ſhadowes towardes the ſouth, and the declination, and altitude, are ninety degrees.

THe ſun towardes the north, and the ſhadowes towardes the ſouth, if ioyning the altitude and declination, they bee ninetie degrees, you are vnder the Equinoctiall line.

The

He that taketh the altitude in the time that the ſunne goeth towardes the North in one of the three parts, he may ſtand that the ſhadowes may be from him towards the South. The firſt is when he is betweene the ſunne and the line, and this hath beene already declared in the rule, before this. The ſecond is, the ſunne being towardes the North and he that taketh the altitude in the ſelfe ſame line. The third is, the ſunne being towardes the North, and hee that taketh the altitude towarde the part of the South, therefore of the ſecond, which is, the man being in the line, the rule ſaith,

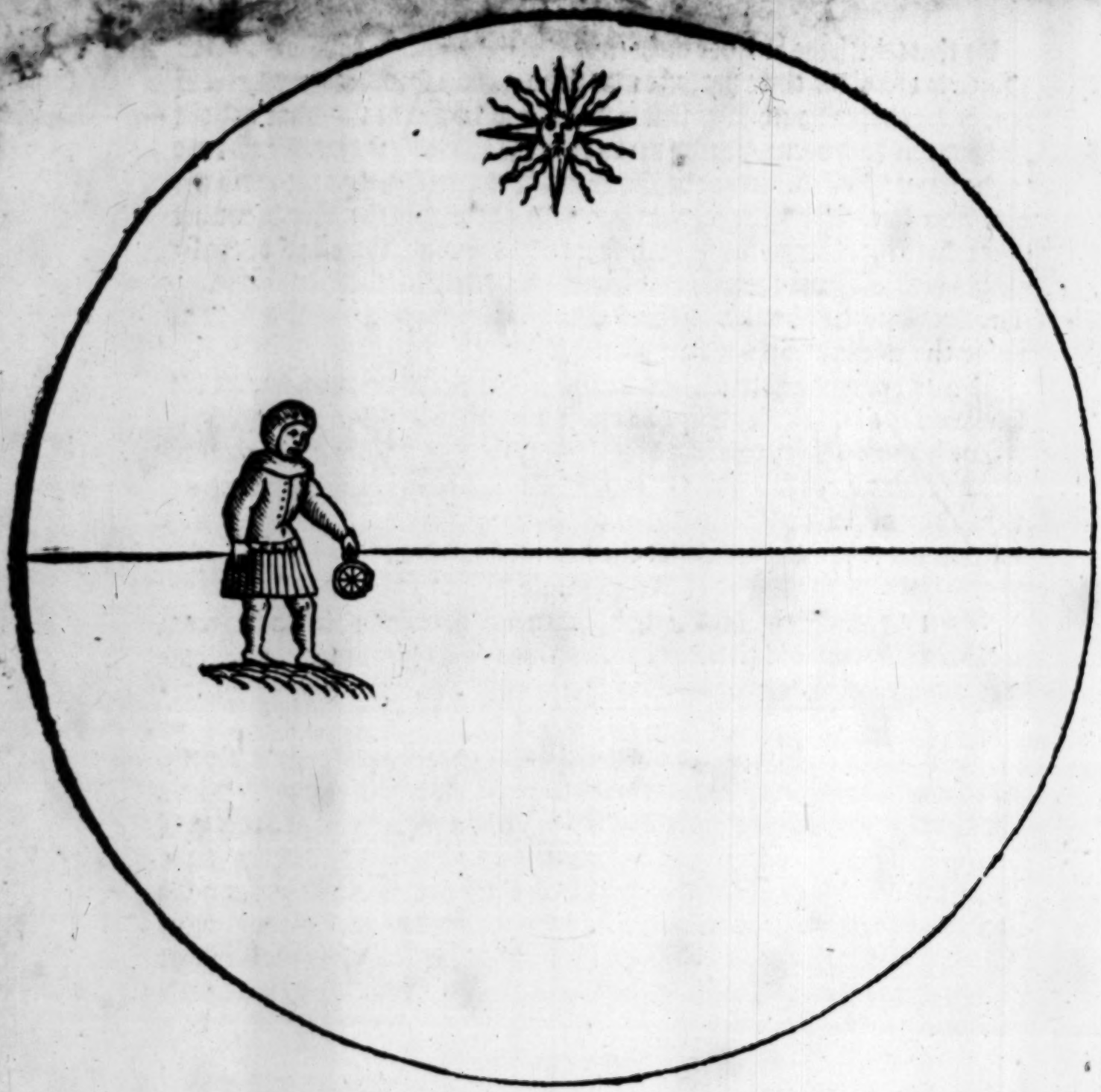
The Sunne at the North parte if the ſhadowes goe towardes the South, ioyne the declination with the altitude.

It is to bee noted, that alwaies when the ſuune goeth to one part, and the ſhadowes to an other, the declination is to bee ioyned with the altitude, And if they be ninetie degrees iuſt. Euen like if there were ſeuentie degrees of altitude and 20. of declination, or eightie of altitude and tenne of declination, or any other number wherein the altitude and declination be ninety degrees iuſt, when it is ſo: you are vnder the Equinoctiall line.

An example.

The 11. day of July I tooke the ſunne in my Aſtrolabio, in 80. degrees, there was this day of declination, 22. degrees, ioyne the altitude and declination, and they amounted to ninetie degrees, then was I vnder the Equinoctiall line.

The reaſon is, becauſe the ſunne was towardes the parte of the North, and the ſhadowes going from me towards the South, I was more towards the South then the ſunne, therefore taking fiftie eight degrees of altitude, I was diſtant from the ſunne twentie two degrees, and this day had the ſunne twentie two degrees of declination, ſo that the ſunne was diſtant from the line twenty two degrees, and I diſtant from the ſunne towards the line, the ſayd twentie two degrees, by the which I knew that I was vnder the ſayde line. For by how much the ſunne was diſtant from the line, ſo much was I diſtant of the ſunne from the ſayd line.



The fourth rule when the ſunne is towardes the North, and the ſhadowes towardes the ſouth, and the altitude and declination doe not amount to ninetie degrees.

THe ſunne at North and the ſhadowes at ſouth, if ioyning the altitude and declination, they come not to ninetie degrees, thoſe that doe lacke for ninetie, you are diſtant of the line towardes the parte of the ſouth, and the line will be betweene you and the ſunne.

It hath beene declared that when the ſunne goeth towardes the parte of the North, if the ſhadowes goe from him that taketh the altitude towardes the South, he may be in one of theſe three places, that is to ſay, towardes the North, betweene the ſunne and the line, and in the ſayde line, and at the parte of the South, the line being betweene him and the ſunne, for in any parte of theſe that a man is, the ſunne going towardes the North parte, alwaies at the middeſt of the day, the ſhadowes will goe towards the South, of theſe three, two haue beene declared, of the third this rule ſpeaketh.

The ſunne towardes the North, if the ſhadowes be towards the ſouth, and ioyning the altitude and declination, if they come not to ninetie degrees.

If the altitude which you haue taken in the Aſtrolabio, were fiftie or ſixtie degrees, and the declination fifteene or twentie, ſo that all being put together, come not to ninetie.

Thoſe which doe lacke for ninetie, you are diſtaunt from the line towardes the South.

So that thoſe degrees and minutes few or many, that be leſſe then ninety, You are diſtant of the line, towardes the parte of the South, and then The line will be betweene you and the ſunne.

An Example.

The tenth of Auguſt, taking the altitude, the ſhadowe was from mee towardes the South: I tooke the ſunne in the Aſtrolabio, in ſeuentie degrees. This day he had of declination twelue degrees: I ioyned the altitude and declination, and they amounted to eightie and two degrees, there lacked eighty degrees for ninetie, theſe eight degrees was I diſtant from the line towardes the parte of the South. The reaſon is, that taking the Sunne in ſeuentie degrees, there was from mee to the Sunne, twentie degrees, and this day the Sunne was diſtant from the line, twelue degrees: which was his declinaton towardes the parte of the North: ſo that the eight which lacketh for twentie, was I diſtant of the line towardes the parte of the South, ſo that from me to the line was eight degrees, and from the line to the Sun twelue, theſe be the tweuty which were from me to the Sunne.





The fifth rule, when the Suune is in the Equinoctiall, and you take his altitude in leſſe then ninetie degrees.

WHen the ſunne is in the Equinoctiall, if you take his altitude in leſſe then ninetie degrees, thoſe which are leſſe then ninetie, you are diſtant from the line towardes that parte which the ſhadowes are from you.

There

There hath beene declared the rules of the altitude of the Sunne, when hee goeth towardes the parte of the North: now this rule serueth for the dayes of the yeere, that the Sunne is in the Equinoctiall line, and sayeth, when the Sunne is in the Equinoctiall line.

The Sunne is in the Equinoctiall, the eleuenth of March, and thirtie of September, so that in any of these dayes, If you take his altitude in lesse then ninetie degrees, so that if you take it in 75. which are lesse by fifteene then ninetie, or in eightie or more or lesse.

Those which you take lesse then ninetie, These fifteene, or tenne, or fiue, or as many as are lesse then ninetie, you are distant from the line vnto the parte which the shadowes do fall from you.

So that if the shadowes goe from you towards the North, those degrees which you find lesse then ninetie, you are distant from the line towardes the part of the North, and if the shadowes goe from you towards the South, the same degrees you shall find your selfe towardes the South.

An Example.

The 11. of March I tooke the Sunne in eightie degrees, the shadowes were from me towardes the North, this day the sunne hath no degree of declination, therefore the ten degrees, which I tooke lesse then ninetie, I was distant from the sunne. The reason is, because the sunne was in the line, the same degrees that I was distant from the sunne, the selfesame am I from the line, and because the shadowes went from me towards the North, was I towardes the parte of the North, the which if they had gone from mee towardes the South, the selfesame degrees should I haue beene towardes the part of the South.

The





The sixt rule, when the altitude is taken in 90. degrees, whether in the sun be a declination or no.

WHen you shall take the altitude of the Sunne in ninetie degrees, the Sunne is ouer your head, looke vpon the declination of this day, and if there bee no declination, you and the Sunne bee in the line, and if there bee any declination, that which is, you are distant from the line, towardes that parte which the Sunne goeth.

This rule declareth how the altitude of the sunne should be knowne, when he that maketh him, hath him in the Cenith, or point that is right ouer his head, the which rule hath two parts, that is to say, one, when the sun is in the Equinoctiall line, and the other when it is forth of it, of the first it speaketh.

When

When you do take the altitude of the sun in 90. degrees. It is to be vnderstood, that the measurer of ỹ world, sheweth in your Astrolabio, the 90. degrees iust, when it is so. Know ye that the sun is right ouer your head: In such sorte, that your shadowe shall not goe to any parte, therefore then Looke on the declination of this day:

Is to be vnderstood the degrees and minutes, which the sunne is distant from the Equinoctiall.

And if there be no declination, Which will be the eleuenth of Marche, and the thirteenth of September, then the declination is of few minutes.

You and the Sun be in the line, the sunne being in the line, then he hath no degree nor halfe a degree of declination, and you are in the line, seeing that you are vnder the sunne.

And if there be any declination: This is the second parte of this rule, wherein is declared, when the sunne, and he that taketh the altitude be out of the Equinoctiall the which will bee knowne in the degrees, that the sun hath of declination, because it saith, that which is, is to be vnderstood few degrees, or many. So much you are distant from the line so that seeing you are vnder the sunne, and the sunne is distant from the line, that the same degrees and minutes, that the sunne hath of declination, the same you are distant from the line, towardes the part where the sunne goeth.

If it bee that the Sunne goeth to the North parte, you are towarde the North part: and if he goe towardes the South, you are toward the same part of the South, and because with this that is declared, this rule may bee well vnderstood, there is put in it no more declaration.

The seuenth rule, when the Sunne is towardes the part of the South, and the shadowes goe likewise towardes the South.

THe sun towards the part of the south, and the shadowes towards the south, the sun is betweene you and the line, looke how many degrees of altitude, you tooke, and how many doe lack for 90, and with those that lack, ioyn the declination of this day, and being altogether the degrees that be, you are distant from the line towards the South.

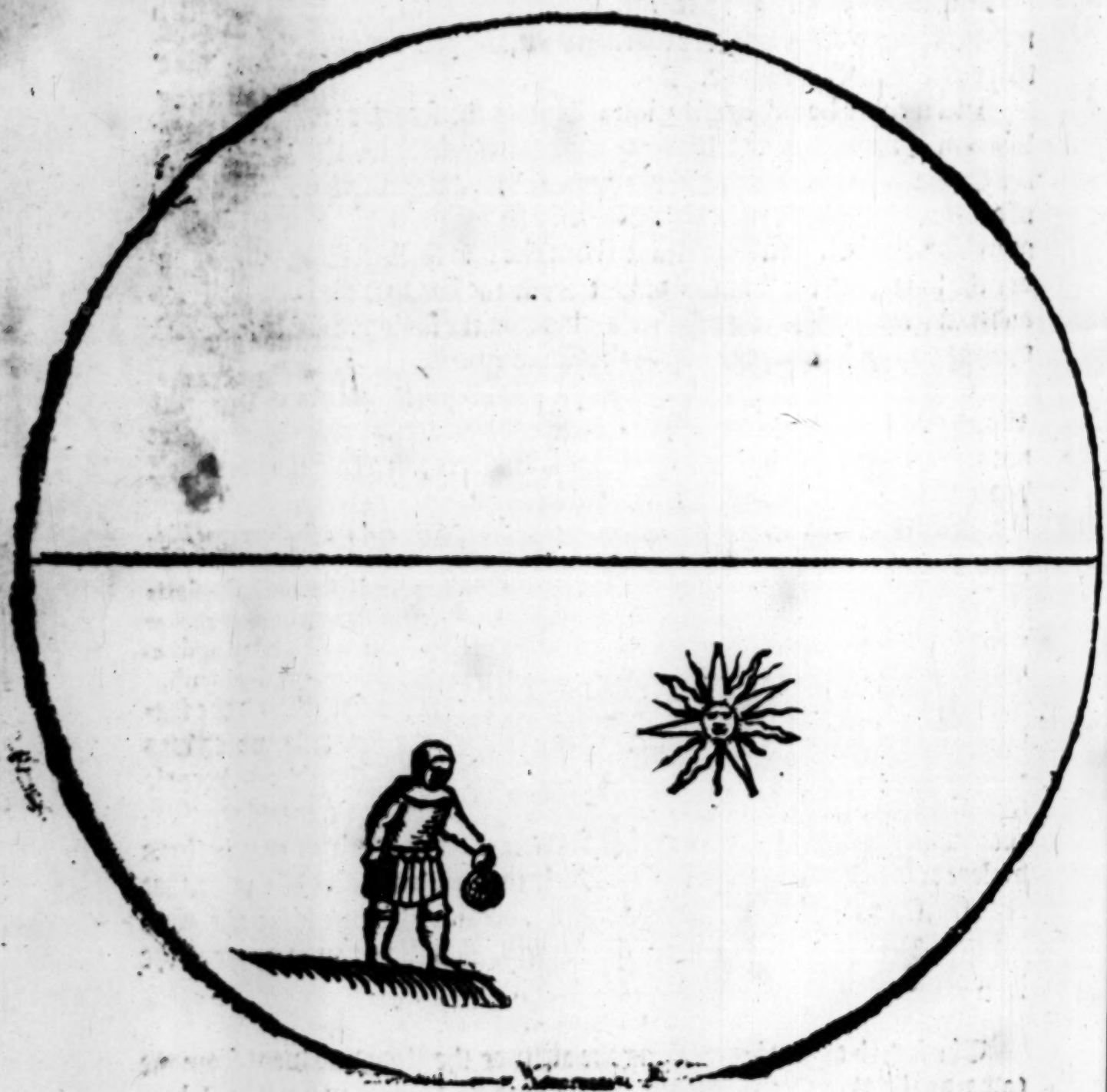
This rule is, when the sunne is towardes the part of the South, and the shadowes goe towardes the South, is agreable with the first rule, which was declared when the sunne goeth towards the parte of the North, and because it is declared according to his proper meaning, and this is agreable to that, there shall not be put there any other declaration, but the same that is there declared, is to be vnderstood in this. Onely making difference of names, that is to say, from the North to the South, but because this rule is for the time when the sunne goeth towardes the South, I will put an example of the part of the South, in the manner following.

An Example.

The fourth of October, taking the altitude, the shadowes went from me towards the South, and I tooke the sunne in 85. degrees in my Astrolabio,

this day the sunne hath 8. degrees of declination towards the South, therefore taking the altitude in 85. degrees, there lacketh fiue, for ninetie, these fiue was I distant from the sunne, and with these fiue, I ioyned the eight of declination, they amounteth to thirteene degrees, these thirteene degrees was I distant from the line, because from me to the sunne was fiue, and from the Sunne to the line eight, which are the thirteene, so that I was distaunt thirteene degrees from the line towardes the parte of the South.

The



The eight rule, when the Sunne is towards the South, and the shadowes towardes the North, and the declination and altitude are more then ninety degrees.

THe Sunne towardes the South, if the shadowes bee towardes the North, ioyne the declination with the altitude, and altogether if they passe of ninetye degrees, those which are more, you are distant of of the line towardes the South, and you are betweene the Sunne and the line.

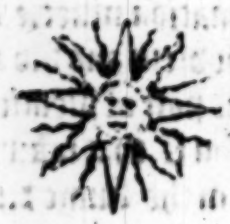
This rule is declared in the second rule before written, when the Sunne goeth towardes the North parte, for the same account or reckoning that is made the sunne being towardes the North and he that taketh the altitude at the same parte of the North, betweene the Sunne and the line, the selfe same is to be done, the sunne being towardes the parte of the South, and he which taketh the altitude in the same parte betweene the Sunne and the line.

Therefore the declaration which is written for the one, by the selfe same fourme serueth for the other, and to know that he which taketh the altitude is betweene the sunne and the line, the rule declareth in what altitude and declination, they should passe of ninety degrees, as it is shewen in this example.

An example.

The xiii. of Ianuarie I tooke the sunne in seuentie eight degrees, this day he had of declination ninetie degrees, I ioyned the declination and altitude as the rule sheweth and did amount to nienty and seuen degrees, these seuen degrees that past of nientie, was I distant from the line towardes the South. The reason is, that taking the sunne in seuentie and eight degrees, I was distant from the sunne xii. degrees, and seeing that the sunne was distant from the line xix. degrees, and I being betweene the Sunne and the line, therefore there are from me to the sunne xii. degrees, and from mee to the line seuen which are nienteene, so many are the degrees which the sun is distant of the line.





The nienth rule, when the Sunne is at the South, and the ſhadowes at North, and the altitude and declination are nientie degrees iuſt.

THe ſunne at ſouth and the ſhadowes at North if ioyning the altitude and declination they bee nine tie degrees, you are in the Equinoctiall line.

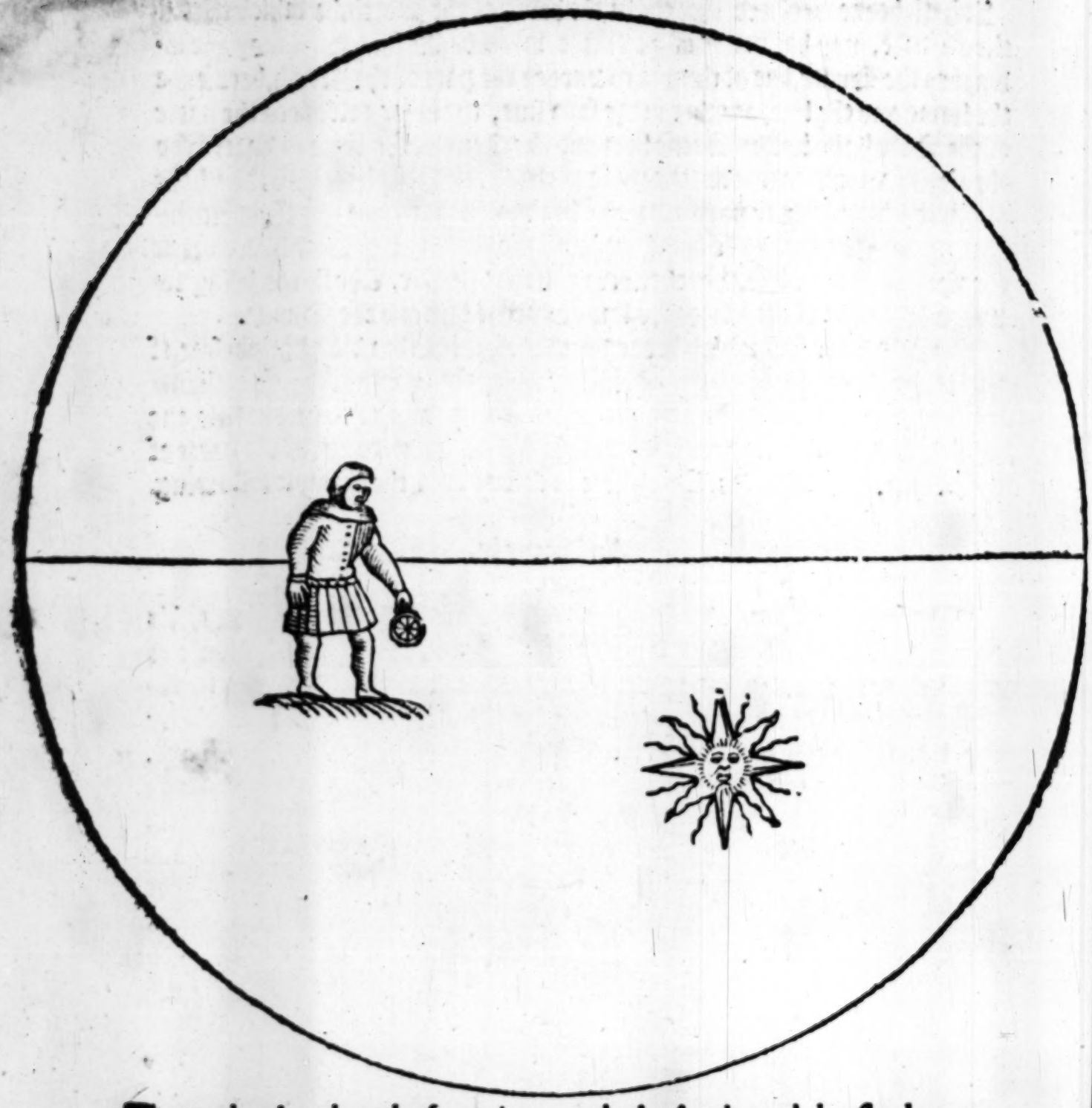
It

It hath beene declared that the Sunne being at the North, he which taketh the altitude, may bee in one of 3. partes whereby his shadowes, may goe towardes the South, one of them is towardes the part of the North, betweene the Sunne and the line, another in the sayd line, the other towardes the parte of the South, the line betweene him and the Sunne, the same is vnderstood the Sunne going towardes the parte of the South, that he which taketh the altitude in one of three partes, he may be that the shadowes goe from him towardes the North, the one being towarde the parte of the South betweene the Sunne and the line, the other being in the said line. The thirde being towardes the part of the North the line betweene him and the Sunne.

Seeing of the first it hath beene written of, and in the rule going before, of the second, which is the Sunne being towardes the parte of the South, and for him which taketh the altitude in the line is put this present rule, the which because in the third rule when the Sunne goeth towarde the parte of the North, it is declared. Only, here is to be noted, the example following.

An Example.

The second of December I tooke the Sunne in fiftie seuen degrees, this day he had of declination twentie three degrees, ioyne the declination, and the altitude, they amounted to ninetie degrees, and being so I was in the Equinoctiall, for because the Sunne at South, the shadowes going from mee towardes the North, I was more towardes the North then the Sunne, the Sunne this day was distant of the line twentie three degrees which was his declination, so that taking the altitude in fiftie seuen degrees, there was from me to the Sunne twentie three degrees, in such sorte that the same twentie three degrees which the Sunne was distant of the line, the same was I distant of the Sunne towardes the line, so therby I knew that I was in the said line.



The tenth rule, when the ſunne is towards the ſouth, and the ſhadowes towards the North, if the altitude and declination being ioyned, they come not to ninety degrees.

THe ſunne at ſouth, and the ſhadowes at North, if the altitude and declination doe not come to ninety degrees, thoſe which doe lacke for ninetie you are diſtant of the line towardes the parte of the North, and the line ſhould be betweene you and the ſunne.

The thirde difference which hath beene ſpoken of, wherein he which taketh the altitude may bee the Sunne being towardes the South, and the ſhadowes going towardes the Noꝛth, is, being towardes the parte of the Noꝛth, the line betweene him and the Sunne, as this rule ſheweth, whoſe declaration is wꝛitten in the fourth rule, when the Sun goeth towards the parte of the Noꝛth. And it is to be noted, that at all times when the Sunne goeth towardes one parte, and the ſhadowes towardes another, the declination is to bee ioyned with the Altitude, and if they paſſe ninetie degrees, thoſe which are moꝛe, you are diſtant of the line, towardes the parte which the Sunne goeth, and if they be ninetie iuſt, you ſhould bee in the line, and if they come not to ninetie, thoſe which are leſſe you are diſtant at the contrarie parte where the Sunne goeth, as in this rule is declared, and thereforꝛe in this example following is to be noted.

An Example.

The thirteenth of September I tooke the Sunne in ſixtie degrees, and the ſhadowes were from mee towardes the Noꝛth, and the Sunne this day had ſixtie degrees and a half of declination I ioyned the declination and altitude, and they amounted to ſixtie and fiꝛe degrees and a halfe, there lacked twenty thꝛee degrees and a halfe foꝛ ninetie. Theſe twentie thꝛee degrees and a halfe was I diſtant from the line towards the parte of the noꝛth. The reaſon is, foꝛ that taking the Sunne in ſixtie degrees there was from me to the Sunne thirtie. I was towardes the parte of the Noꝛth, and the Sunne towardes the parte of the South diſtant from the line, fiꝛe degrees and a halfe, ſo that of the thirtie degrees, which were from me to the Sunne, taking out the fiꝛe and a halfe which the ſunne is diſtant from the line, there will be from me to the line twenty thꝛee degrees and a halfe.





The first Chapter, wherefore the rules of the height of the Sunne, doe shew the degrees that a man is distant of the Equinoctiall line more then by any other parte.

IN the rules before written hath beene declared howe that euery day that you will take the altitude of the Sunne, you shall knowe at what parte of of the line you are, and how many degrees distant as well of the one part as of the other.

Of

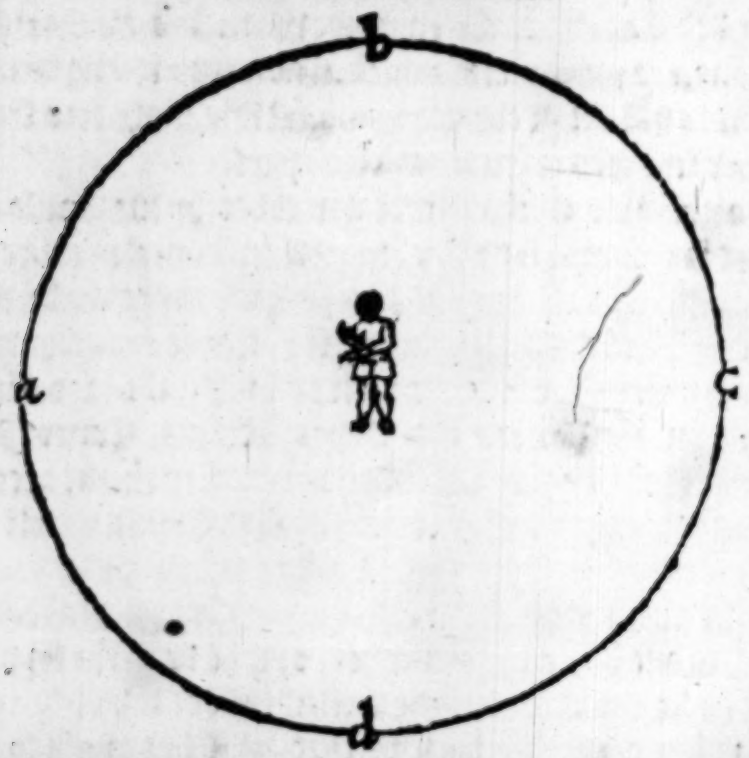
Of this may be asked, what the cause is, wherefore all the rules of the altitude of the sunne, are made and ordained, that a man should vnderstand how many degrees he is distant of the Equinoctial line, more then from the pole, or from the other tropikes or from any other part.

To this is to be answered, that the reason whereby we would onely know the distance that is from the sayd line, more then from any other parte, is, because the sayd Equinoctiall line, as before hath beene declared, is put and scituated in the midst of the world, and all the Cardes of Nauigation wherby the pylots and sailers doe rule themselues by. In the card of Nauigation are ordained and put the Portes, and Bayes, Riuers, Capes, Ilandes, and shoolues, and all other thinges, which are marked in them, according to the degrees that euery thing is distant from the sayd Equinoctiall line, as well towards the part of the north, as of the south: and being knowne by the pilot or sailer, with the altitude which he taketh, how many degrees he is distant of the sayd line, to one parte or to another, or if he be in the sayd line, likewise he knoweth if he be equal in altitude with the place which hee goeth to seeke according as in his carde hee hath pricked, or if hee ought to rise vp or goe downe, and how many degrees, vntill he put him selfe right of the place, and for this cause the line is more sought for, then any other part.

The seuenth chapter, by what reason all rules of the altitude of the Sun are reduced to ninetie degrees, more then any other number.

IT may be asked by what reason all the rules of the altitude of the Sunne, as before hath beene declared goe reduced to this number of ninetie degrees, more then to any other, for that is so written, that the degrees of altitude are to be seene, wherein the sunne is taken in the Astrolabio, how many doe lacke, vnto ninetie and in other rules is sayd that the altitude and declination is to be ioyned and seene if they amount to ninetie degrees, or if they passe ninetie degrees, or if they come not to ninety degrees, in such sort, that all the rules are made and ordained to this number of ninetie, therefore it ought to be knowne wherefore more to this number then to any other. For the vnderstanding of this doubt is to be imagined, that whersoeuer a man standeth is the middest of the worlde, and hee seeth halfe the heauen, in such sort, that as the roundnes of the world hath three hundreth and sixtie degrees, the Horizon discouereth the halfe which are a hundreth and eightie, and they are vnderstoode in this manner: from any manner of parte of the Horizon vnto the Cenith are ninety degrees, and from my Cenith vnto the other parte of the Horizon other ninety. Which is to be vnderstood in this maner, imagine that in what place so euer a man is in, he is right in the middest of this circle, which circle is his Horizon.

There-



Therefore I say that I am in the midst of the circle, and from the point A. which is the Horizon vnto my head are ninety degrees, and from my Cenith to the point C. other ninetie, which are a hundreth and eightie, and from the point B. vnto my head ninetie, and from my heade vnto the pointe D. other ninety, and so there is ninety degrees from my head to any parte of my Horizon. Therefore declaring the doubt, I say that the reason why the rules of the altitude of the Sunne are reduced to this number of nientie, is because the Sunne cannot rise vp aboue the Horizon, more then nientie degrees, which is vntill he come right ouer our heades, and so when we take him in ninetie degrees of Astrolabio, we say that we haue the Sunne right ouer our heades, and when we take him in lesse, that which is lesse then nienty is the Sunne distant from vs: so that because the Sunne cannot rise vp, vpon the Horizon more then nienty degrees, with the which as I haue sayde, hee commeth vntill he be vpon our heades: therefore the rules of his altitude goe reduced to this number, and not to any other.

The eight Chapter, wherein is declared wherefore we say, that the man is distant of the Sunne, the degrees that he taketh in the Astrolabio lesse then nientie.

Of the rules of the altitude of the Sun before written, hath beene said, and declared, that at all times when the altitude is taken, the degrees are to be looked for which doe lacke in the Astrolabio of nienty, and that those same, the man is distante of the Sunne. And because it is conuenient and expedient that this rule be well and throughly vnderstoode and knowne, I will

will most euidently declare it, in this manner following.

It is to be noted, when the Sunne doth beginne to appeare by our Horizon which is, when he goeth forth in the morning, then he hath no altitude but from thence he goeth rising vp, and how much more he riseth, so much he goeth hauing more altitude, vpon the Horizon, in such sort that if one houre after he is come forth, he hath rayled himselfe vp fiue degrees, in two houres hee shall haue rayled himselfe vp teene or twelue, and in three houres more, and so hee goeth rising vp vntill the middest of the day, and from thence hee turneth to descend by the same order that he went rising vp, vntill he put or hyde himselfe vnder the Horizon. Of that which hath beene sayd, two things are to be noted, the first is, that from the time the sunne commeth forth, vntil it be in the middest of the day, he goeth alwayes rising vp, and augmenting in his altitude, vntill he come to the Meridian, and alwaies the Meridian is in the middest of the bow, which the Sunne maketh, from the time that hee commeth forth vntill hee is set. This is because alwaies the man is in the middest of the roundnes, which roundnes is his Horizon,

The second is, that this Bowe which the Sunne maketh vpon our Horizon is not euery day equall, but at some times is greater then at other some, euen as the day is great or little, but although that the bowe be great or little, alwayes the Sunne goeth rising vp, vntill he come to the Meridian, and from thence hee descendeth, And it is to bee noted, that alwaies the Sunne commeth forth, and setteth in equall distance from vs, but at the middest of the day, he is not alwayes in equal distance of vs, but at one time he is neere, and at another time farre off, this is from the right of our heades, which is to be vnderstoode in this manner. I put the case that I be distant from the Equinoctiall line tenne degrees, and the Sunne hath of declination the same daye the same tenne degrees, towardes the parte that I am, and being so, when the Sunne came forth this day, and began to appeare in the Horizon, then he was from me ninetie degrees, and from thence he went rising vp vntill the middest of the day, and being come to my Meridian, he shall bee precisely right ouer my head.

Insomuch that if a line be imagined, that rightly doth descend from the Sunne vnto the earth, this line would come vpon my head, and this woulde be so at all times, when I were as distant of the line, as the declination is, which the Sunne hath this day, because I am in that way where the Sun that day doth make his mouing, by the which that day at the middest of the day, I shall haue it vpon my head: but if it be distant of the way of the Sun, although that when he came forth, he was from me ninety degrees, it is to be vnderstood, that when it is in the middest of the day, I shal not haue it right ouer my head, but I shall haue it as farre of, as the distance is from the place, where I am, to the place of the way of the Sunne, in such sorte that

if

if the distance which is of the place or way, where I am, to the place or way where the Sunne came forth, were fiue degrees, or tenne, or more or lesse: Those same the Sunne shall be in the middest of the day distant from the right of my head, so that, if there were layd two straight lines or strekes, from the East into the West, the one by the place where the Sunne commeth forth, and the other by the place where I am: the degrees of distance that should be from one line to the other, the selfesame at the middest of the day, will be of distance of the Sunne to my Cenith.

And doe you note, that in this distance, which the Sunne maketh from me is not to be looked, howe much there is from mee to the Sunne, but doe you looke how much the Sunne is distant at the middest of the day, from the right of my head, for so much as this distance is, so much will I say, that I am distant of the Sunne, to one part or other.

The nienth Chapter, wherein is declared, how it is to be vnderstoode, that a man hath the Sunne right ouer his head.

IT hath beene declared in the Chapter going before, that when a man findeth himselfe in the course where the sunne maketh his way, that that day at the middest of the day, he shall haue him right ouer his heade, of this may be had a great doubt, (which is this.)

A doubt. It hath beene declared in the seconde Chapter of this fourth Booke, according to the opinion of Ptholome, and Alfragano, that the sun is an hundreth and sixtie and sixe times greater then the earth: and that the Sunne is so great, it appeareth well, seeing that continuall he giueth light to al the stars of the heauen, the heauen being so great, and the stars so many in number, as the royall prophet saith, that God only doth reckon and number them. Likewise the greatnesse of the Sunne doth shewe, in the which, although that there be alwayes put all the roundnesse of the water and earth betweene the Sunne and the heauen in such sorte, that continually, he putteth himselfe before, according to the sight of man, whereby we see not any more then halfe the heauen: and although the earth and the water are so great bodies, yet they occupie not any thing, nor deteyne the light of the Sunne, that it doe not passe to giue light to all the starres. This is because the earth and the water are so little thinges in respect of the Sunne, that well neere they may be compared to a graine of mustard seede, put before a great torch lighted, which doth let nothing of the light thereof, but that it doth extend to all parts. Therfore all the earth being so little in comparison of the Sunne, and the man being well neere of no quantitie in respect of all the earth, it seemeth to be farre out of reason, to say that a man should haue the Sunne right ouer his head in any time or place, euen as there should bee no reason to say, that a great ship going by the Sea, may be right vpon the

poynt

poynt of a little nayle, which were in the depth of the water: or that a great cloude should be right vpon a little worme of the earth, euen as well it seemeth, that there is no reason to say, that the Sunne is right ouer the head of a man: seeing that the Sun is alwayes, and sheweth it selfe vpon the halfe of all the earth, by the which reason likewise it seemeth, that it ought not to be thought, that the Sunne in one time is in the Equinoctiall, and another time at the North parte, and another at the South parte, seeing that these are partes of the earth, and the Sunne not only is greater then these parts, but in very great quantitie, greater then all of them, as it is sayd, and so it is prooued and seemeth that it is an improper thing, to say that the Sunne is right vpon our head, or that he is in one part or other of the earth.

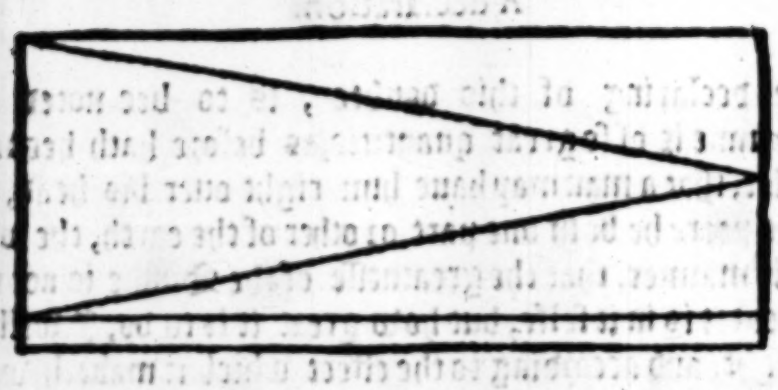
A declaration.

For the declaring of this doubte, is to bee noted, That although the Sunne is of so great quantitie, as before hath beene declared, this doth not let, that a man may haue him right ouer his head, and in the discourse of the yeere he be in one part or other of the earth, the which is vnderstood in this manner, that the greatnesse of the Sunne is not to be considered how great it is in it selfe, but how great it is to vs. I will say according to our sight, and according to the effect which it maketh with vs. (An example of this is) that many times it happeneth to men that goe sayling, and they see very farre of in the Sea a ship, and although she bee very great, and goeth very swiftly, it seemeth to him that beholdeth her, that she is little, and that she mooueth not: the same doth happen to vs with a great cloude, which the wind doth carry with great lightnesse: this is caused for the great distance that is from the one to the other, in such sorte, that wee iudge not as it is, but according as the sight doth represent it to vs: euen so the Sunne although he be very great, and mooueth with great hast, wee iudge not of it, but according to our sense, for because in as much as toucheth the hastines of his mouing, as the earth is well neere a point of the circle, which the Sun maketh, it is certaine, that it cannot be perceiued or knowne according as his mooving is, this is by reason of the great distance that is betweene him and vs, and so by this great distance he commeth to diminish himselfe so much in our sight that he may be right ouer the head of one man, and not right ouer the head of another, that is one league from him.

This is shewed, that in taking the altitude of the Sunne, one man will take him very precisely right ouer his owne heade, and another although he be neere, will find him farre of from him, this is because he was more right ouer the heade of the one then of the other. Likewise this is shewed by the shadowes, the which doe shew infallibly the mooving which the sunne maketh

from

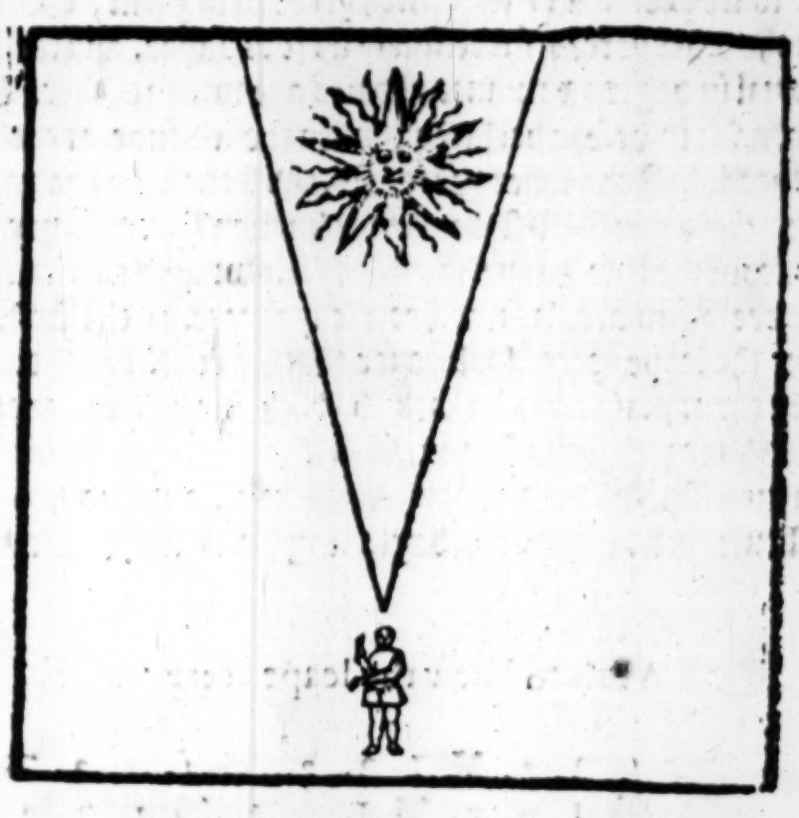
from one parte to another: in such sorte, that in one place one man may haue his shadowe ſo right, that at the middeſt of the day, the Sunne doth make no shadow to any part, and to another that is not farre from thence, although he be in the ſame Meridian, and at the ſame houre and minute. The shadowe will decline to ſome part, whereby it manifeſtly appeareth, to haue the Sun right ouer our heed, and how it mooueth not onely by the middeſt, but likewiſe by the ſides of the earth. And for the better declination of that alſo, eſpecially is to be noted, that naturally all thinges which we ſee, the ſight doth comprehende it by Apiramide, ſo ſaith Alacen in the perſpectiue in the 17. rule, that the comprehenſion of all thinges viſible is by a rooted pyramide. The pyramide is to be imagined in this manner.



So that although the thing be great, it commeth diminiſhing by the lightening of the ſight, vntill it remayne in the little ſpace or place of the light of our eye, ſo that in our eye doth containe, a mountayne or great hill, how great ſo euer it bee, therefore we may ſay, that the greatnes of the Sunne, by a pyramide commeth diminiſhing vntill he be vpon our heades,

this

this is when a man is precisely put vnder the centre of the Sunne in this



forte, and so it is to bee vnderstoode, when we say to haue the Sunne vpon our head, or to be distant of vs to one part or other.

The tenth Chapter, to know the altitude of the Sunne ought to be seene if it be leape yeere, or what yeere it is.

IN the first Chapter of this fourth booke, I said how it is necessary when the altitude of the Sunne is taken to knowe the yeere, if it bee the leape yeere, or the first or second, or thirde after the leape yeere, because the dayes of one yeere, with those of the other haue not the degrees and minutes equal, and the reason is, because as in the third chapter of this fourth booke hath beene declared, that the yeere called Solar, hath three hundreth sixtie fiue dayes, and sixe houres, and that those sixe houres of euery one yeere, from foure to foure yeeres, doe make a naturall day, and that such a yeere is called a leape yeere, so that the first yeere after the leape yeere, hath three hundreth sixtie fiue dayes and sixe houres. And the second yeere, three sixtie fiue dayes and twelue houres, the sixe of the first yeere, and sixe his owne, and the third yeere, three hundreth sixtie fiue dayes and eighteene houres, the twelue

twelue of these two yeeres the first and second, and the third this owne, and the fourth yeere 366. dayes, So that in this fourth yeere, Is shut vp the houres of all foure yeeres, and the fourth yeere being past, The first beginneth, and so the other yeeres successiuely as it is sayde, and for this cause they be not equal in degres & minuts a daies one with another. Therfore it is conuenient, as it is before declared, when the altitude of the Sunne is to be taken, that it be seene what yeere it is, and seeke what day and moneth you are in, and there you shall finde the declination, or distance which the Sunne hath from the line, as in the tables following is contained, therfore to know the yere ỳ you are in, if it bee a leape yeere, or the first, second, or the third after the leape yeere, looke ouer the two rules of the discourses following, for in them plainely is shewed, by reckoning the yeere of our Lord, a thousand fiue hundreth fortie fiue in the first house of the which is the first yeere, and so successiuely in euery yeere one house, and the house being ended of the last rule, returne to the beginning, and so this account is for euer.

A rule to know the leape yeere.

1545. ☞ 1. 2. 3. ♋ 1 2. 3. ♋ 1. 2. 3. ♋ 1. 2. 3.
♋ 1. 2. 3. ♋ 1. 2. 3. ♋ 1. 2. 3. ♋.

When you will know the yeere be a leape yeere, do not without looking in the booke, looke in the yeere of the birth of our Lord, and leaue the thousand fiue hundreth, the rest deuide in the middest, and when euerie halfe were of euen number in payers or cupples it is the leape yeere,

The tables of the distance or declination which the Sunne maketh from the Equinoctiall line euery day of the foure yeeres, aswell towardes the part of the North as towardes the South.

January.

First.	Second.	Third.	Fourth.	
1	2	3	4	
1593	1594	1595	1596	Yeere of
1597	1598	1599	1600	the Lord.
1601	1602	1603	1604	
1605	1606	1607	1608	
1609	1610	1611	1612	

D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	21	50	1	21	52	1	22	56	1	21	57
2	21	40	2	21	43	2	22	9	2	21	48
3	21	30	3	21	33	3	21	36	3	21	38
4	21	20	4	21	23	4	21	26	4	21	28
5	21	9	5	21	16	5	21	15	5	21	17
6	20	58	6	21	1	6	21	4	6	21	7
7	20	47	7	20	50	7	20	53	7	20	55
8	20	35	8	20	38	8	20	41	8	20	44
9	20	22	9	20	26	9	20	29	9	20	32
10	20	9	10	20	13	10	20	16	10	20	20
11	19	56	11	20	0	11	20	3	12	20	6
12	19	43	12	19	47	12	19	50	12	19	53
13	19	29	13	19	33	13	19	36	13	19	39
14	19	14	14	19	19	14	19	22	14	19	25
15	19	0	15	19	4	15	19	8	15	19	11
16	18	45	16	18	49	16	18	53	16	18	56
17	18	29	17	18	34	17	18	38	17	18	41
18	18	14	18	18	19	18	18	22	18	18	26
19	17	58	19	18	3	19	18	7	19	18	11
20	17	42	20	17	46	20	17	50	20	17	54
21	17	25	21	17	30	21	17	34	21	17	38
22	17	8	22	17	13	22	17	17	22	17	21
23	16	51	23	16	56	23	17	0	23	17	4
24	16	32	24	16	38	24	16	43	24	16	47
25	16	16	25	16	21	25	16	25	25	16	29
26	15	57	26	16	3	26	16	7	26	16	12
27	15	39	27	15	45	27	15	49	27	15	54
28	15	21	28	15	26	28	15	30	28	15	35
29	15	2	29	15	7	29	15	12	29	15	17
30	14	43	30	14	48	30	14	53	30	14	58
31	14	24	31	14	29	31	14	34	31	14	39

February.

First.	Second.	Third.	Fourth.
1	2	3	4
1593	1594	1595	1596
1597	1598	1599	1600
1601	1602	1603	1604
1605	1606	1607	1608
1609	1610	1611	1612
D. G. M.	D. G. M.	D. G. M.	D. G. M.
1 14 4	1 14 9	1 14 14	1 14 19
2 13 44	2 13 50	2 13 54	2 14 0
3 13 24	3 13 29	3 13 35	3 13 40
4 13 4	4 13 9	4 13 15	4 13 20
5 12 44	5 12 49	5 12 54	5 13 0
6 12 23	6 12 28	6 12 34	6 12 39
7 12 2	7 12 7	7 12 13	7 12 18
8 11 41	8 11 46	8 11 52	8 11 58
9 11 20	9 11 25	9 11 31	9 11 37
10 10 58	10 11 4	10 11 10	10 11 15
11 10 37	11 10 43	11 10 48	11 10 54
12 10 15	12 10 21	12 10 26	12 10 33
13 9 53	13 9 59	13 10 5	13 10 11
14 9 31	14 9 37	14 9 43	14 9 49
15 9 9	15 9 15	15 9 21	15 9 27
16 8 47	16 8 53	16 8 59	16 9 5
17 8 25	17 8 30	17 8 36	17 8 43
18 8 2	18 8 7	18 8 13	18 8 20
19 7 36	19 7 45	19 7 51	19 7 58
20 7 16	20 7 22	20 7 28	20 7 35
21 6 53	21 6 59	21 7 5	21 7 12
22 6 30	22 6 36	22 6 42	22 6 49
23 6 7	23 6 13	23 6 19	23 6 26
24 5 44	24 5 50	24 5 56	24 6 4
25 5 21	25 5 27	25 5 32	25 5 40
26 4 58	26 5 3	26 5 9	26 5 17
27 4 34	27 4 40	27 4 45	27 4 54
28 4 10	28 4 17	28 4 22	28 4 37
			29 4 7

March.

First,	Second.	Third.	Fourth.
1	2	3	4
1593	1594	1595	1596
1597	1598	1599	1600
1601	1602	1603	1604
1605	1606	1607	1608
1609	1610	1611	1612

D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	3	47	1	3	53	1	3	59	1	3	43
2	3	24	2	3	29	2	3	35	2	3	19
3	3	0	3	3	6	3	3	12	3	2	56
4	2	36	4	2	42	4	2	48	4	2	32
5	2	13	5	2	18	5	2	25	5	2	9
6	1	49	6	1	55	6	2	1	6	1	45
7	1	25	7	1	31	7	1	37	7	1	22
8	1	2	8	1	11	8	1	14	8	0	59
9	0	39	9	0	47	9	0	50	9	0	34
10	0	15	10	0	20	10	0	26	10	0	11
11	0	8	11	0	3	11	0	3	11	0	12
12	0	32	12	0	27	12	0	21	12	0	36
13	0	56	13	0	51	13	0	44	13	0	59
14	1	19	14	1	14	14	1	8	14	1	23
15	1	43	15	1	37	15	1	31	15	1	46
16	2	6	16	2	1	16	1	55	16	2	10
17	2	30	17	2	24	17	2	18	17	2	33
18	2	54	18	2	48	18	2	41	18	2	56
19	3	17	19	3	11	19	3	5	19	3	20
20	3	41	20	3	34	20	3	28	20	3	45
21	4	3	21	3	57	21	3	25	21	4	6
22	4	27	22	4	21	22	4	51	22	4	29
23	4	50	23	4	44	23	4	38	23	4	52
24	5	13	24	5	7	24	5	1	24	5	15
25	5	36	25	5	30	25	5	24	25	5	38
26	5	59	26	5	52	26	5	47	26	6	1
27	6	21	27	6	15	27	6	10	27	6	23
28	6	44	28	6	38	28	6	32	28	6	46
29	7	6	29	7	1	29	6	55	29	7	8
30	7	29	30	7	23	30	7	18	30	7	30
31	7	51	31	7	46	31	7	40	31	7	52

Aprill.

First.			Second.			Third.			Fourth.		
1			2			3			4		
1593			1594			1595			1596		
1597			1598			1599			1600		
1601			1602			1603			1604		
1605			1606			1607			1608		
1609			1610			1611			1612		
D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	8	13	1	8	8	1	8	10	1	8	15
2	8	35	2	8	30	2	8	25	2	8	37
3	8	57	3	8	52	3	8	47	3	8	58
4	9	19	4	9	14	4	9	9	4	9	19
5	9	41	5	9	36	5	9	30	5	9	41
6	10	2	6	9	57	6	9	52	6	10	2
7	10	23	7	10	18	7	10	13	7	10	23
8	10	44	8	10	40	8	10	34	8	10	44
9	11	5	9	11	1	9	10	55	9	11	5
10	11	25	10	11	21	10	11	16	10	11	25
11	11	45	11	11	42	11	11	36	11	11	46
12	12	6	12	12	2	12	11	56	12	12	6
13	12	26	13	12	22	13	12	16	13	12	26
14	12	46	14	12	45	14	12	36	14	12	46
15	13	6	15	13	3	15	12	56	15	13	5
16	13	25	16	13	23	16	13	16	16	13	25
17	13	44	17	13	42	17	13	35	17	13	44
18	14	4	18	14	1	18	13	55	18	14	3
19	14	22	19	14	20	19	14	14	19	14	22
20	14	41	20	14	38	20	14	32	20	14	40
21	14	59	21	14	58	21	24	51	21	14	59
22	15	17	22	15	15	22	15	9	22	15	17
23	15	35	23	15	33	23	15	27	23	15	35
24	15	53	24	15	50	24	15	45	24	15	52
25	16	10	25	16	8	25	16	2	25	16	9
26	16	27	26	16	25	26	26	19	26	16	27
27	16	44	27	16	42	27	16	36	27	16	43
28	17	1	28	16	58	28	16	53	28	17	0
29	17	17	29	17	14	29	17	9	29	17	16
30	17	33	30	17	30	30	17	26	30	17	32

May.

First.	Second.	Third.	Fourth.
1	2	3	4
1593	1594	1595	1596
1597	1598	1599	1600
1601	1602	1603	1604
1605	1606	1607	1608
1609	1610	1611	1612
D. G. M.	D. G. M.	D. G. M.	D. G. M.
1 17 49	1 17 45	1 17 41	1 17 46
2 17 57	2 18 1	2 17 57	2 18 3
3 18 12	3 18 16	3 18 12	3 18 18
4 18 27	4 18 31	4 18 27	4 18 33
5 18 41	5 18 45	5 18 45	5 18 48
6 18 56	6 19 0	6 18 56	6 19 2
7 19 9	7 19 13	7 19 10	7 19 16
8 19 23	8 19 27	8 19 23	8 19 29
9 19 36	9 19 40	9 19 38	9 19 42
10 19 49	10 19 53	10 19 50	10 19 56
11 20 2	11 20 6	11 20 3	11 20 8
12 20 14	12 20 17	12 20 15	12 20 20
13 20 26	13 20 30	13 20 27	13 20 32
14 20 38	14 20 41	14 20 39	14 20 43
15 20 49	15 20 53	15 20 50	15 20 54
16 21 0	16 21 4	16 21 1	16 21 5
17 21 10	17 21 14	16 21 11	17 21 16
18 21 20	18 21 24	18 21 22	18 21 26
19 21 30	19 21 34	19 21 32	19 21 35
20 21 39	20 21 43	20 21 41	20 21 45
21 21 49	21 21 52	21 21 50	21 21 54
22 21 57	22 22 0	22 21 59	22 22 2
23 22 6	23 22 8	23 22 7	23 22 10
24 22 14	24 22 16	24 22 15	24 22 18
25 22 21	25 22 24	25 22 22	25 22 25
26 22 28	26 22 31	26 22 30	26 22 33
27 22 35	27 22 37	27 22 36	27 22 39
28 22 41	28 22 43	28 22 42	28 22 45
29 22 47	29 22 49	29 22 48	29 22 51
30 22 51	30 22 54	30 22 53	30 22 56
31 22 54	31 23 0	31 22 58	31 23 1

June.

First.			Second.			Third.			Fourth.		
1			2			3			4		
1593			1594			1595			1596		
1597			1598			1599			1600		
1601			1602			1603			1604		
1605			1606			1607			1608		
1609			1610			1611			1612		
D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	22	5	1	23	4	1	23	3	1	23	0
2	23	9	2	23	8	2	23	7	2	23	10
3	23	13	3	23	12	3	23	11	3	23	13
4	23	16	4	23	16	4	23	15	4	23	17
5	23	19	5	23	19	5	23	18	5	23	20
6	23	22	6	23	21	6	23	21	6	23	22
7	23	24	7	23	23	7	23	23	7	23	24
8	23	26	8	23	25	8	23	25	8	23	26
9	23	27	9	23	26	9	23	26	9	23	27
10	23	28	10	23	27	10	23	27	10	23	28
11	23	28	11	23	28	11	23	28	11	23	28
12	23	28	12	23	28	12	23	28	12	23	28
13	23	28	13	23	28	13	23	28	13	23	28
14	23	27	14	23	27	14	23	27	14	23	26
15	23	26	15	23	26	15	23	26	15	23	25
16	23	24	16	23	25	16	23	25	16	23	23
17	23	22	17	23	23	17	23	23	17	23	21
18	23	19	18	23	20	18	23	21	18	23	18
19	23	16	19	23	17	19	23	18	19	23	15
20	23	13	20	23	14	20	23	15	20	23	12
21	23	9	21	23	10	21	23	11	21	23	8
22	23	5	22	23	6	22	23	7	22	23	4
23	23	1	23	23	2	23	23	4	23	22	56
24	22	56	24	22	57	24	22	58	24	22	54
25	22	51	25	22	52	25	22	53	25	22	49
26	22	45	26	22	46	26	22	48	26	22	43
27	22	38	27	22	40	27	22	41	27	22	37
28	22	32	28	22	34	28	22	35	28	22	30
29	22	25	29	22	27	29	22	26	29	22	23
30	22	18	30	22	20	30	22	21	30	22	15

Iuly.

First.	Second.	Third.	Fourth.
1	2	3	4
1593	1594	1595	1596
1597	1598	1599	1600
1601	1602	1603	1604
1605	1606	1607	1608
1609	1610	1611	1612

D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M
1	22	10	1	22	12	1	22	21	1	22	12
2	22	2	2	22	4	2	22	6	2	22	4
3	21	54	3	21	56	3	21	58	3	21	56
4	21	45	4	21	47	4	21	49	4	21	47
5	21	35	5	21	38	5	21	40	5	21	38
6	21	26	6	21	28	6	21	28	6	21	28
7	21	16	7	21	19	7	21	21	7	21	19
8	21	6	8	21	6	8	21	11	8	21	2
9	20	55	9	20	58	9	21	0	9	20	52
10	20	44	10	20	47	10	20	49	10	20	40
11	20	33	11	20	36	11	20	38	11	20	29
12	20	21	12	20	24	12	20	26	12	20	17
13	20	9	13	20	12	13	20	14	13	20	5
14	19	57	14	20	0	14	20	6	14	19	52
15	19	44	15	19	47	15	19	49	15	19	4
16	19	31	16	19	34	16	19	36	16	19	27
17	19	17	17	19	20	17	19	23	17	19	13
18	19	4	18	19	7	18	19	10	18	18	59
19	18	42	19	18	53	19	18	56	19	18	45
20	18	35	20	18	38	20	18	43	20	18	31
21	18	21	21	18	24	21	18	28	21	18	16
22	18	6	22	18	9	22	18	13	22	18	1
23	17	51	23	17	54	23	17	58	23	17	47
24	17	35	24	17	38	24	17	42	24	17	30
25	17	19	25	17	23	25	17	26	25	17	14
26	17	3	26	17	6	26	17	11	26	16	58
27	16	47	27	16	50	27	16	55	27	16	42
28	16	30	28	16	33	28	16	38	28	16	25
29	16	13	29	16	17	29	16	21	29	16	8
30	15	56	30	16	0	30	16	4	30	15	51
31	15	39	31	15	42	31	15	47	31	15	33

August.

First,	Second.	Third.	Fourth.
1	2	3	4
1593	1594	1595	1596
1597	1598	1599	1600
1601	1602	1603	1604
1605	1606	1607	1608
1609	1610	1611	1612

D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	15	21	1	15	25	1	15	30	1	15	15
2	15	3	2	15	7	2	15	12	2	14	57
3	14	45	3	14	49	3	14	54	3	14	39
4	14	27	4	14	31	4	14	36	4	14	20
5	14	8	5	14	12	5	14	18	5	14	2
6	13	49	6	13	53	6	13	59	6	13	43
7	13	30	7	13	34	7	13	40	7	13	24
8	13	9	8	13	15	8	13	2	8	13	5
9	12	51	9	12	56	9	13	2	9	12	41
10	12	31	10	12	36	10	12	42	10	12	25
11	12	12	11	12	16	11	12	23	11	12	5
12	11	52	12	11	56	12	12	3	12	11	41
13	11	32	13	11	36	13	11	42	13	11	25
14	11	11	14	11	16	14	11	22	14	11	4
15	10	51	15	10	59	15	11	2	15	10	44
16	10	30	16	10	35	16	10	41	16	10	23
17	10	9	17	10	14	17	10	20	17	10	2
18	9	48	18	9	53	18	9	59	18	9	41
19	9	27	19	9	31	19	9	39	19	9	19
20	9	5	20	9	10	20	9	16	20	8	58
21	8	44	21	8	49	21	8	55	21	8	35
22	8	22	22	8	27	22	8	33	22	8	15
23	8	0	23	8	5	23	8	11	23	7	53
24	7	38	24	7	43	24	7	50	24	7	31
25	7	16	25	7	21	25	7	28	25	7	9
26	6	53	26	6	59	26	7	5	26	6	47
27	6	31	27	6	36	27	6	43	27	6	25
28	6	9	28	6	14	28	6	20	28	6	1
29	5	46	29	5	51	29	5	57	29	5	39
30	5	23	30	5	29	30	5	31	30	5	16
31	5	0	31	5	6	31	5	12	31	4	53

September.

First, 1		Second. 2		Third. 3		Fourth. 4	
1593		1594		1595		1596	
1597		1598		1599		1600	
1601		1602		1603		1604	
1605		1606		1607		1608	
1609		1610		1611		1612	
D.	G. M.	D.	G. M.	D.	G. M.	D.	G. M.
1	4 38	1	4 42	1	4 49	1	4 43
2	4 14	2	4 20	2	4 26	2	4 20
3	3 51	3	3 56	3	4 3	3	3 57
4	3 28	4	3 33	4	3 39	4	3 34
5	3 5	5	3 10	5	3 16	5	3 12
6	2 37	6	2 47	6	2 53	6	2 47
7	2 18	7	2 23	7	2 29	7	2 24
8	1 55	8	2 0	8	2 6	8	2 1
9	1 31	9	1 37	9	1 43	9	1 37
10	1 8	10	1 13	10	1 19	10	1 14
11	0 45	11	0 49	11	0 56	11	0 51
12	0 21	12	0 26	12	0 32	12	0 27
13	0 2	13	0 3	13	0 9	13	0 3
14	0 25	14	0 21	14	0 15	14	0 20
15	0 48	15	0 44	15	0 38	15	0 43
16	1 12	16	1 8	16	1 2	16	1 7
17	1 35	17	1 31	17	1 25	17	1 30
18	1 58	18	1 55	18	1 48	18	1 54
19	2 22	19	2 18	19	2 12	19	2 17
20	2 45	20	2 45	20	2 35	20	2 41
21	3 9	21	3 5	21	2 59	21	3 4
22	3 32	22	3 28	22	3 22	22	3 27
23	3 55	23	3 51	23	3 45	23	3 50
24	4 18	24	4 15	24	4 9	24	4 14
25	4 41	25	4 38	25	4 32	25	4 37
26	5 4	26	5 1	26	4 55	26	5 0
27	5 27	27	5 23	27	5 18	27	5 23
28	5 51	28	5 46	28	5 41	28	5 46
29	6 14	29	6 9	29	6 4	29	6 8
30	6 36	30	6 32	30	6 26	30	6 31

October.

First.	Second.	Third.	Fourth.
1	2	3	4
1593	1594	1595	1596
1597	1598	1599	1600
1601	1602	1603	1604
1605	1606	1607	1608
1609	1610	1611	1612

D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	7	0	1	6	54	1	6	48	1	6	53
2	7	22	2	7	17	2	7	11	2	7	16
3	7	44	3	7	39	3	7	33	3	7	38
4	8	7	4	8	1	4	7	55	4	8	1
5	8	29	5	8	24	5	8	18	5	8	23
6	8	51	6	8	46	6	8	40	6	8	45
7	9	13	7	9	8	7	9	2	7	9	7
8	9	36	8	9	30	8	9	24	8	9	30
9	9	58	9	9	52	9	9	42	9	9	52
10	10	19	10	10	13	10	10	8	10	10	13
11	10	41	11	10	35	11	10	29	11	10	35
12	11	2	12	11	0	12	10	51	12	10	56
13	11	23	13	11	18	13	11	12	13	11	17
14	11	45	14	11	39	14	11	33	14	11	39
15	12	5	15	12	0	15	11	54	15	11	59
16	12	26	16	12	21	16	12	15	16	12	20
17	12	47	17	12	41	17	12	36	17	12	41
18	13	7	18	13	1	18	12	56	18	13	1
19	13	27	19	13	22	19	13	17	19	13	21
20	13	47	20	13	41	20	13	36	20	13	41
21	14	6	21	14	1	21	13	56	21	14	1
22	14	26	22	14	21	22	14	16	22	14	17
23	14	45	23	14	40	23	14	35	23	14	39
24	15	4	24	14	59	24	14	54	24	14	58
25	15	23	25	15	17	25	15	13	25	15	17
26	15	41	26	15	36	26	15	31	26	15	35
27	15	59	27	15	54	27	15	50	27	15	54
28	16	17	28	16	12	28	16	8	28	16	12
29	16	35	29	16	30	29	16	25	29	16	29
30	16	52	30	16	47	30	16	43	30	16	47
31	17	9	31	17	4	31	17	0	31	17	4

Nouember.

First.	Second.	Third.	Fourth.
1	2	3	4
1593	1594	1595	1596
1597	1598	1599	1600
1601	1602	1603	1604
1605	1606	1607	1608
1609	1610	1611	1612

D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	17	26	1	17	21	1	17	17	1	17	36
2	17	42	2	17	38	2	17	33	2	17	53
3	17	58	3	17	54	3	17	49	3	18	9
4	18	14	4	18	9	4	18	6	4	18	25
5	18	29	5	18	25	5	18	22	5	18	41
6	18	44	6	18	40	6	18	37	6	18	55
7	18	59	7	18	55	7	18	52	7	19	10
8	19	14	8	19	10	8	19	6	8	19	24
9	19	26	9	19	24	9	19	21	9	19	38
10	19	42	10	19	36	10	19	35	10	19	52
11	19	45	11	19	52	11	19	48	11	20	5
12	20	8	12	20	5	12	20	7	12	20	18
13	20	21	13	20	18	13	20	14	13	20	30
14	20	34	14	20	30	14	20	27	14	20	43
15	20	46	15	20	42	15	20	39	15	20	54
16	20	57	16	20	54	16	20	51	16	21	6
17	21	8	17	21	5	17	21	3	17	21	17
18	21	19	18	21	16	18	21	14	18	21	27
19	21	29	19	21	27	19	21	24	19	21	37
20	21	39	20	21	37	20	21	35	20	21	47
21	21	49	21	21	47	21	21	44	21	21	56
22	21	58	22	21	56	22	21	54	22	22	5
23	22	7	23	22	5	23	22	3	23	22	14
24	22	15	24	22	21	24	22	11	24	22	21
25	22	23	25	22	14	25	22	19	25	22	29
26	22	31	26	22	29	26	22	27	26	22	36
27	22	38	27	22	37	27	22	34	27	22	43
28	22	44	28	22	43	28	22	41	28	22	49
29	22	50	29	22	49	29	22	47	29	22	55
30	22	56	30	22	54	30	22	53	30	23	0

December.

First.			Second.			Third.			Fourth.		
1			2			3			4		
1593			1594			1595			1596		
1597			1598			1599			1600		
1601			1602			1603			1604		
1605			1606			1607			1608		
1609			1610			1611			1612		
D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	23	1	1	23	0	1	22	58	1	23	5
2	23	6	2	23	5	2	23	4	2	23	10
3	23	10	3	23	9	3	23	8	3	23	14
4	23	14	4	23	13	4	23	12	4	23	17
5	23	15	5	23	17	5	23	16	5	23	20
6	23	20	6	23	20	6	23	9	6	23	22
7	23	23	7	23	22	7	23	22	7	23	25
8	23	25	8	23	25	8	23	24	8	23	26
9	23	26	9	23	26	9	23	26	9	23	22
10	23	27	10	23	27	10	23	27	10	23	28
11	23	28	11	23	28	11	23	28	11	23	28
12	23	28	12	23	28	12	23	28	12	23	28
13	23	28	13	23	28	13	23	28	13	23	27
14	23	27	14	23	27	14	23	27	14	23	26
15	23	26	15	23	26	15	23	26	15	23	24
16	23	24	16	23	24	16	23	25	16	23	21
17	23	21	17	23	22	17	23	23	17	23	18
18	23	19	18	23	20	18	23	20	18	23	15
19	23	16	19	23	17	19	23	17	19	23	12
20	23	12	20	23	13	20	23	14	20	23	8
21	23	8	21	23	7	21	23	10	21	23	6
22	23	3	22	23	4	22	23	5	22	22	57
23	22	58	23	22	59	23	23	1	23	22	52
24	22	52	24	22	54	24	22	56	24	22	46
25	22	47	25	22	48	25	22	50	25	22	40
26	22	40	26	22	42	26	22	43	26	22	33
27	22	36	27	22	35	27	22	37	27	22	25
28	22	30	28	22	28	28	22	30	28	22	18
29	22	22	29	22	20	29	22	22	29	22	9
30	22	14	30	22	12	30	22	14	30	22	0
31	22	6	31	22	4	31	22	6	31	21	52

Ianuarie.			Februarie.			March.		
1	A	New yeeres day.	1	D		1	D	
2	b		2	e	Purification of Mary	2	e	
3	c		3	f		3	f	
4	d		4	g		4	g	
5	e		5	A	Shroue sunday.	5	A	
6	f	Twelfe day.	6	b		6	b	
7	g		7	c		7	c	
8	A		8	d		8	d	
9	b		9	e		9	e	
10	c		10	f		10	f	
11	d		11	g		11	g	
12	e		12	A		12	A	S. Gregory.
13	f		13	b		13	b	S. Leonard.
14	g		14	c		14	c	
15	A		15	d		15	d	
16	b		16	e		16	e	
17	c		17	f		17	f	
18	d		18	g		18	g	S. Gabriell archan.
19	e		19	A		19	A	
20	f		20	b		20	b	
21	g	S. Fabian ans Seba.	21	c		21	c	
22	A	S. Vincent martyre.	22	d		22	d	
23	b		23	e		23	e	
24	c		24	f	S. Matthias apostle.	24	f	Annun. of ma.
25	d	Couer. of S. Paul	25	g		25	g	Easter day.
26	e		26	A		26	A	
27	f		27	b		27	b	
28	g		28	c		28	c	
29	A					29	d	
30	b					30	e	
31	c					31	f	

The Calender.

April.			May.			June.		
1	g		1	b	S. Phil. and	1	e	
2	A		2	c	Jacob.	2	f	
3	b		3	d	Inuenci. of	3	g	
4	c		4	e	the crosse.	4	A	
5	d		5	f	Ascention	5	b	
6	e		6	g	day.	6	c	
7	f		7	A		7	d	
8	g		8	b		8	e	
9	A		9	c		9	f	
10	b		10	d		10	g	
11	c		11	e		11	A	Barnabe
12	d		12	f		12	b	apostle.
13	e		13	g		13	c	
14	f		14	A	Whitsunday.	14	d	
15	g		15	b	S. Allbon	15	e	
16	A		16	c	archbish. of	16	f	
17	b		17	d	Deuill.	17	g	
18	c		18	e		18	A	
19	d		19	f		19	b	
20	e		20	g		20	c	
21	f		21	A		21	d	
22	g		22	b		22	e	
23	A	S. George	23	c		23	f	
24	b	martyr.	24	d		24	g	S. John
25	c	S. Marke	25	e		25	A	Baptist.
26	d	Euang.	26	f		26	b	
27	e		27	g		27	c	
28	f		28	A		28	d	
29	g		29	b		29	e	
30	A		30	c		30	f	S. Peter
			31	d				and Paul.

Iulie.			August.			September.		
1	g		1	c		1	f	
2	A		2	d		2	g	
3	b		3	e		3	A	
4	c		4	f		4	b	
5	d		5	g		5	c	
6	e		6	A	Translatiu.	6	d	
7	f		7	b	of our Lord.	7	e	The natiuity
8	g		8	c		8	f	of our Ladie.
9	A		9	d		9	g	
10	b		10	e	Saint Laurence.	10	A	
11	c		11	f		11	b	
12	d		12	g	S. Clare virgine.	12	c	
13	e		13	A		13	d	
14	f		14	b		14	e	
15	g		15	c	Assumption of Marie.	15	f	
16	A		16	d		16	g	
17	b		17	e		17	A	
18	c		18	f		18	b	
19	d		19	g		19	c	
20	e		20	A		20	d	S. Matthew apostle.
21	f		21	b		21	e	
22	g	Mary Magdalen.	22	c		22	f	
23	A		23	d		23	g	
24	b		24	e	S. Bartholomew apo.	24	A	
25	c	S. James.	25	f		25	b	
26	d	Saint Anne	26	g		26	c	
27	e	S. Christopher.	27	A	S. Austin,	27	d	S. Michaell archan.
28	f		28	b	The cutting	28	e	
29	g		29	c	off of Saint	29	f	S. Jerome.
30	A		30	d	John Baptist head.	30	g	
31	b		31	e				

The Calender.

October.			November.			December.		
1	A		1	d	Al saints day	1	f	
2	b		2	e	The remem-	2	g	
3	c		3	f	brance of the	3	A	
4	d		4	g	that are	4	b	
5	e		5	A	dead.	5	c	S. Barbara
6	f		6	b		6	d	
7	g		7	c		7	e	S. Nicho-
8	A		8	d		8	f	las bishop.
9	b		9	e		9	g	Conception
10	c		10	f		10	A	of Mary.
11	d		11	g		11	b	
12	e		12	A		12	c	
13	f		13	b		13	d	S. Luce vir-
14	g		14	c	S. Martin.	14	e	gine.
15	A		15	d		15	f	
16	b		16	e		16	g	
17	c		17	f		17	A	
18	d	S. Luke e-	18	g		18	b	
19	e	uangelist.	19	A		19	c	
20	f		20	b		20	d	
21	g	Theri. M.	21	c		21	e	
22	A	virgins.	22	d		22	f	S. Thomas
23	b		23	e		23	g	apostle.
24	c		24	f		24	A	
25	d		25	g	Saint Cle-	25	b	Christmas
26	e		26	A	ment.	26	c	Steuen
27	f		27	b	Saint Ka-	27	d	John euan.
28	g	S. Simon.	28	c	thern.	28	e	Innocentes.
29	A	and Jude.	29	d	S. Andrew	29	f	
30	b		30	e	apostle.	30	g	
31	c					31	A	

A rule to know the dominicall letter.

euery yeere.

For to knowe in what day of the weake is euery feast of the yeere. It is necessary you know what letter it is that serueth for Sunday. This is to be knowne by the rules of the letters vnder written, in the which, the first letter which is D. serueth for the Dominicall letter, this yeere of 1545 and so successiuely in euery yeere one letter serueth, and the two rules being ended, returne agayne to the beginning, and this is for euer. And this is to be noted that in the leape yeeres are two Dominicall letters. The letter aboue being vppermost serueth from the first day of Januarie, vnto the xxv. of Februarie, and the other vnto the ende of the yeere.

1545.	D	C	B.	A	F	E	D.	C	A	G	F.	E	C	B	A.									
						G				B				D										
G	E	D	C.	B	G	F	E.	D	B	A	G.	F												
				F				A				C				E								

The eleuenth Chapter, wherein is declared how by the Calender before written, a man may know the moneth, and the day wherein he is.

The Philosopher saith, ẏ the art doth imitate nature as much as he may. Likewise ẏ said art many times helpeth ẏ deffects of nature, this is proued, wherein we see that a man which by nature doth want his sight, the Art doth helpe and remedy his want, that is by looking on a payre of spectacles, wherby in such sort, the sight is gathered together, and is cause that he seeth, the which he doth not without them for that it is scattered abroad. The selfe same which is said of the sight, may be said of the memorie, that many times it lacketh in men, but it is certaine that in some it commeth by nature, but in other by their owne vncarefulnesse that they forget themselues so much, that in thinges which standeth them much vpon, they take no heede. And concerning this I doe remember as we came sayling in a ship, nienteene men, which were seuen passengers and twelue mariners, and hauing bin many dayes at the Sea, because the weather was contrary, there happened a cause whereby it was conuenient that the purser should write it down in his booke for to giue reason thereof when the time should serue, and bee with the other that were there, knewe not what day of the moneth it was.

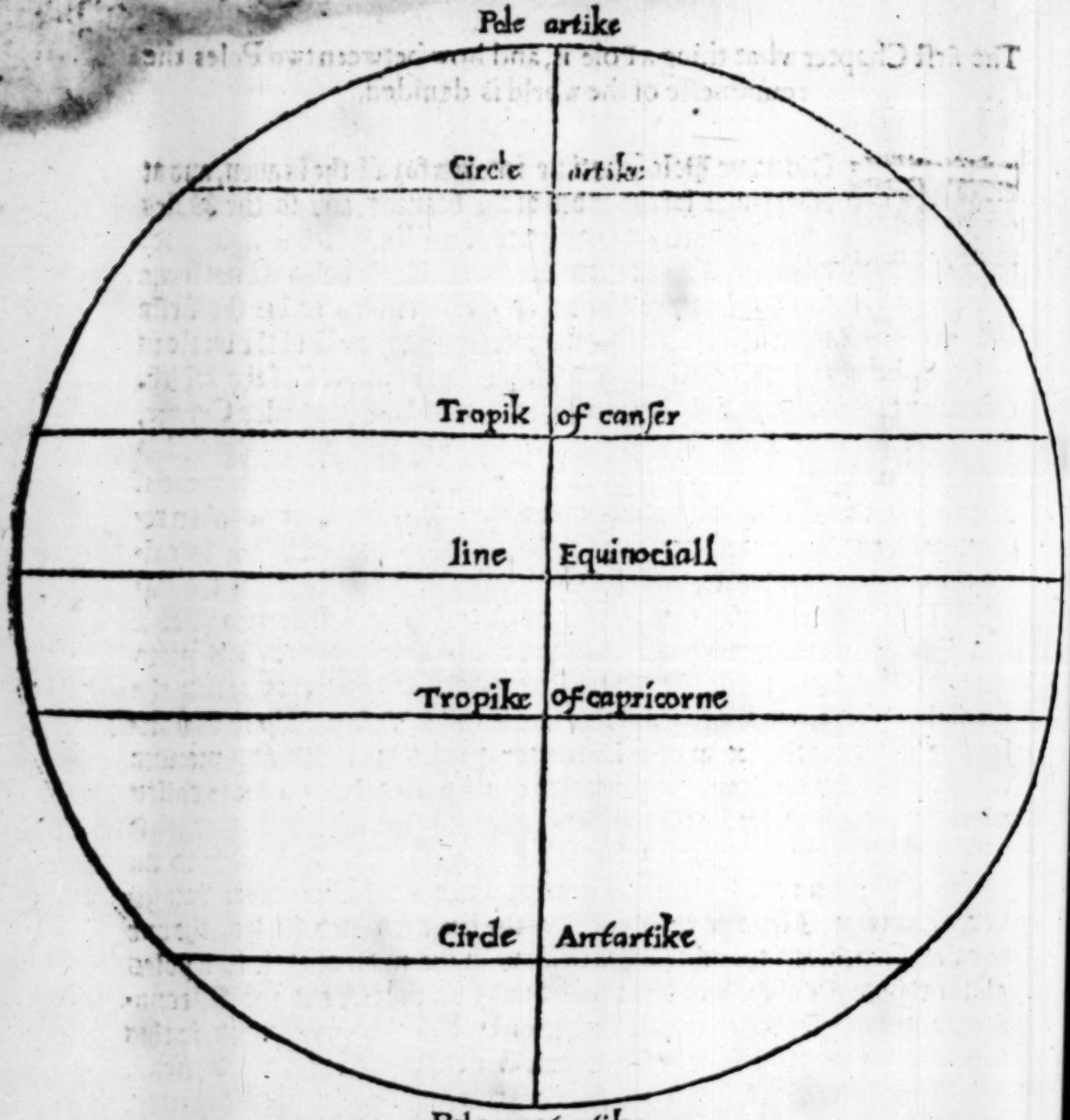
ship there was anye that have it in his remembrance, nor knewe what daye was the firste daye of the Moneth, vntill I tolde him, nor any booke in the shippe to looke in whereby it might be knowne. And this being brought for my purpose, I say that here before hath beene declared, that one of the thinges which ought to be seene and knowne, for to take the altitude of the Sonne, is the declination or distance which it hath that day from the Equinoctiall line, for not knowing the declination howe much it is, the said altitude cannot be knowne, whereby it is necessary that the Pylot or any other person which shall take the sayde altitude should knowe in what moneth he is in, and how many dayes of the moneth it is, without hauing any errour or want therein. And because of that as I haue spoken of before, which happened, it may happen the like in others, or likewise if he that taketh the altitude bee alone, or with little company, and do not remember the reckoning aforesayd, for this it seemeth to me to bee a conuenient thing to help the memory by putting here the Calender before written, whereby may bee kept a certayne remembrance and a reckoning of the moneth and day wherein he is, by looking what day euery moneth beginneth, without any need to aske it of any. And because some that doe goe by some wayes which hath not much vsed it, are accustomed to set markes to know it the better. So in this Calender, for the better knowledge thereof, I haue put markes which are the Saintes dayes. Therefore I say to know what day in the weeke is euery holy day of them aforesayd. The letters must bee seene which standeth before those dayes of euery moneth, and see what letter of these serueth in this yeere for Sunday, and it is called the dominicall letter, which shall be knowne by the rule afore written, and being knowne, to stay in it which is Sunday, and in another which is next Munday, and in the other Tuesday. And so all the seuen dayes of the weeke named by the seuen letters A B C D E F G. And by reckoning in this manner, see what day is the letter which is next to the holy day, and in that yeere that is the proper day of such a feast, the leape yers as before hath been declared, haue two dominicall letters, the one serueth vnto the xxv. day of Februarie, and the other vnto the end of the yeere.

The ende of the Fourth booke.

The first Chapter what thing a Pole is, and how between two Poles the roundnesse of the world is deuided.

THis name Pole sometime is taken for all the heauen, and at other times for the endes of the heauens, and so the Poles vnderstood here, by the 2. ends of one Ex, which is imagined, whereupon the heauens doe moue. These poles are not seene but are imagined and they are imagined to bee the firste moueable. In this manner, the roundnesse of the world is called Sphera, as before hath beene declared: in the middest of the which, according to the definition of Theodosio, is a poynt which is called Center, this poynt is taken in two sortes, one according to the truth, and of this speaketh Euclides in the beginning of the Booke entituled De Elementis, It is a poynt which hath no parte, in another sorte, this poynt is taken respectiuely, and so the earth in respect of the heauen is a poynt which is called the Center of the world, so saith the Philosopher in the fourth of the naturall Philosophie, seeing that by the middest of this poynt, is imagined a straight line, the vttermost partes whereof doe stretch or reach to both parts of the circumference: this line which some do call Diameter, is called the Ex of the Sphera, and the endes of this line is called Poles. There is a difference betweene the Ex, and the Diameter, properly is called any manner of line, which deuideth any body into two equal partes, but the Ex is called a line, set in both Poles, in the which is imagined that some body turneth it selfe in circle manner, of the which doth follow, that in the heauen is no more then one Ex: and there are an infinite number of Diameters imagined, Therefore I say that those endes of the Ex are called Poles, the one is called Artick, and the other Antartick, and in the midst of these two poles all the roundnesse of the world is deuided into fiue partes, and the Astronomers and Philosophers doe call them zonas, and they are deuided in this manner. The first Zone is from the Pole Articke, vnto the circle Articke, and this hath in latitude twentie three degrees, and thirtie three minutes. The second from the circle Articke to the Tropike of Cancer, hath in latitude 42. degrees, and 54. minutes the third from the tropike of Cancer to the tropike of Capricorne hath in altitude 47. degrees and 6. minutes. The fourth from the tropike of Capricorne, to the circle Antarticke, hath in latitude 40. and 2. degrees, and 54. minutes. The fifth from the circle antartick vnto the pole antartick, hath in latitude, 23. degrees, and 33. minutes; so that from one Pole to the other, are a hundreth and fourescore degrees.

These Zonas the firste is called Septentrionall, the seconde Solsticiall, the third Equinoctiall, the fourth Vemoll, the fifth Australl. And it is to



be noted, that these two Poles, the one is superiour, and the other inferiour. And according to Albertus the great in the second booke of the heauen, and the worlde, the first treatie, the fire Chapter, they are to bee considered in this manner, in as much as toucheth the mooning of the circle of the fixed starres.

The Pole Antarticke is the superiour, and the Pole Arricke is the inferiour, and according to the circle of the Planets, the Pole Articke is the superiour, and the Antarticke the inferiour, and it is to bee vnderstoode, that such

such as dwell in the Equinoctiall line, onely the place of the one Pole they see, and so we doe onely see in the heauen, the place where we imagine the one Pole to bee: and this is called Articke, likewise Septentrionall, or Boreall: It is called Articke, because it is neere to the image called Arture. It is called Septemtrionall, by the seuen starres of the Vrsa minor, which doth moue round about the sayd Pole. It is called Boreall by the winde Boreas, which we call North. The other Pole is called Antartico, which is against, as though it were but contrarie or opposite to the Articke, and Australl, because from that parte commeth the winde called Austro: it is called Meridionall, because it is towardes the part of the middest of the day, it is to be vnderstood, that it standeth towards the part of the middest of the day to such as doe dwell towards the North, out of the Tropike of Cancer, because in all times of the yeere at the middest of the day, we haue the Sunne towardes that parte.

The second Chapter, howe the altitude of the Pole Articke is to bee taken, and of the effect whereof he is taken.

The Pilot or any other person that will take the altitude of the Pole Articke, which commonly we call the Altitude of the North, let him take his Blalestila or quadrant, or the instrument he hath most vsed, let him take the altitude of the sayd starre, as precisely as he can, and for the better taking thereof, let him put himselfe neer to the masse of the shippe, for there shall he feele least of all the mooung of the ship.

And it is to be noted, that the altitude of the Pole is taken, to knowe the distance of the degrees, that are from the Horizon vnto the Pole, for these degrees being knowne, is knowne howe many degrees they are from him which taketh the altitude vnto the Equinoctiall line, and it is knowne in this manner. The Pole Articke, or the Antarticke either of them, is distant from the Equinoctiall line, ninetie degrees, therfore let him looke that taketh the altitude how many degrees he hath raised the Pole vpon the Horizon, and he shall vnderstand, that the selfesame degrees are from the place where he is vnto the Equinoctiall line, so that if he bee vnder the Equinoctiall, he shal not take altitude of any of the Poles, because he shall haue them in the Horizon. But being come forth of the Equinoctiall, how much hee is distant from her, so much he shall haue the one Pole raysed vp, and the other put downe, so that how many degrees hee is distant from the line, in so many he shall take the altitude of that Pole, towardes the parte where hee is. For so many, he hath raised vpon him his Horizon. In such sorte, that if he tooke the altitude of the Pole in teene degrees, the sayd teene degrees he is distant of the Equinoctiall, and if in twentie, twentie, and so the rest. In such

such sorte, that whensoeuer the altitude of the Pole is taking, looking by her the degrees that are raised vpon the Horizon, the selfesame he which taketh the altitude is distant from the Equinoctiall line.

The thirde Chapter, howe the reckoning which is taking of the height of the Pole Artick or North, is to be vnderstoode.

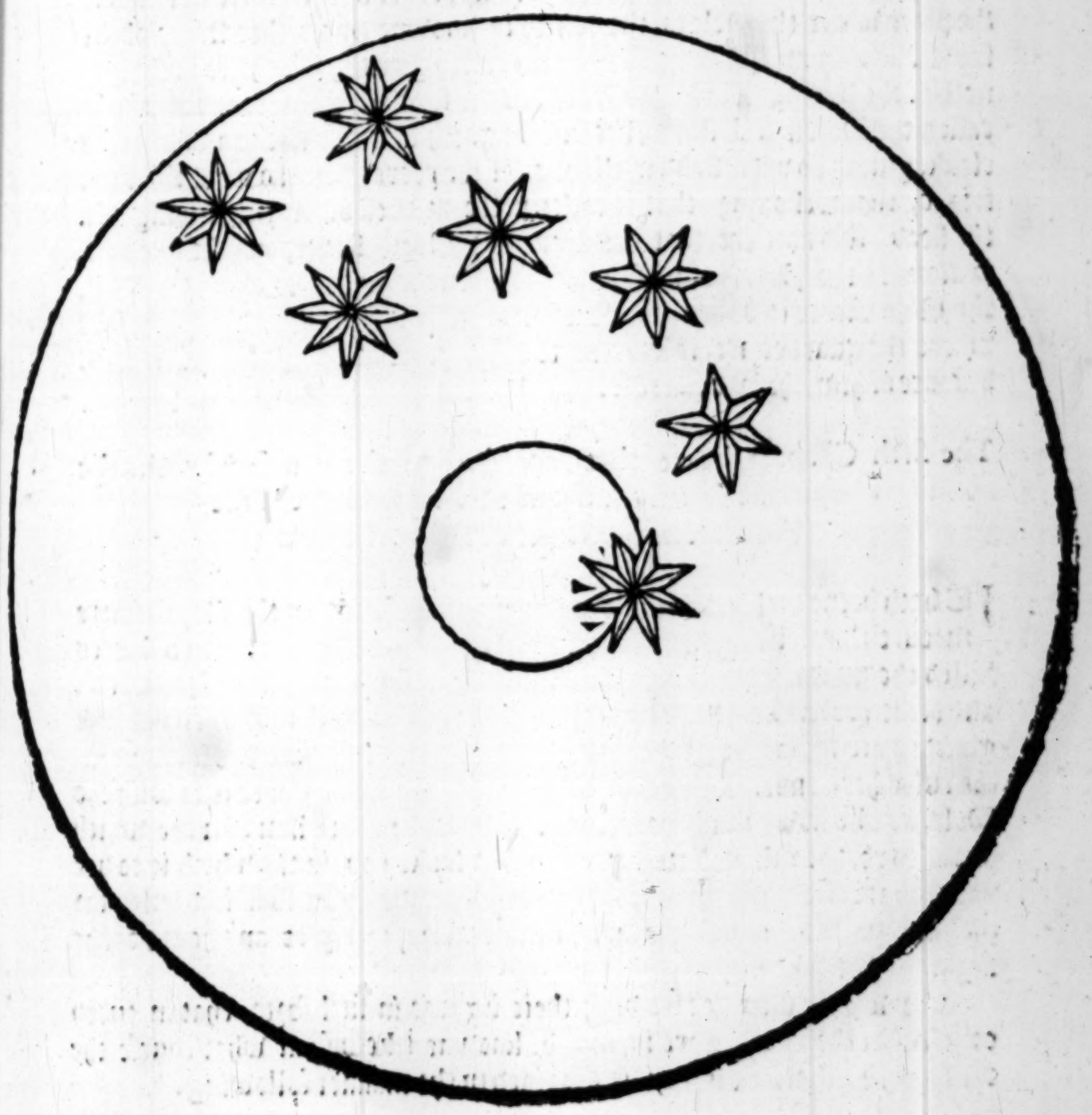
IT hath beene declared in the Chapter before this, that how many degrees are taken of the altitude of the Pole, so many is he which taketh her distant of the Equinoctiall line, because for this effect to know the distance of the sayd line, the sayd altitude is taken, therefore in this present, I will speake how this altitude which is taken of the Pole is to be vnderstoode. Of the which it is to be vnderstood, that when a man is in the Equinoctiall line, he hath both Poles in the Horizon, as before hath beene declared, and by howe much he is going from the sayd line, and commeth towardes the Pole Artick or North Pole, which is this that we speake of, by so much the Pole goeth rising vpon his Horizon, so that if the man be distant of the line twentye degrees, the same twentie hee hath the Pole aboue his Horizon. Of this is to bee noted, that the degrees which are taken of the altitude of the Pole, are not to be vnderstoode of those which are from him, that taketh the altitude vnto the Pole ie selfe: But it is to be vnderstood, that those haue gone railing vp the sayd Pole aboue his Horizon. For because like as in the altitude of the Sunne, is not noted howe much the Sunne is rayled aboue him that taketh his altitude, but it is to be seene, howe much hee is rayled aboue the Horizon, which are seene by these degrees, which are taken in the Astrolabio, so that in the altitude of the North, it is not to bee looked, howe much the Pole is rising vpon him, which taketh his altitude, but that which he is risen aboue his horizon, in such sort, that to know ỹ height of the Pole, there is no account or reckoning, to be taken betweene him that taketh it and the Pole, but ele reckoning is betweene him that taketh it and the Horizon. For if the man should keepe the reckoning with the Pole, it would be sayd in this manner, from the Equinoctial line, to the Pole, are nienty degrees, distant from the Equinoctiall line: then it should bee threescore and teene degrees from the Pole, and would say, seeyng I am in seuenty degrees of altitude, I am so many from the Pole.

This ought not to be vnderstood so, for it would be a very great errour, so much that being in twentie degrees of altitude, hee that should so make his reckoning, should make that he were in seuentie. But let the reckoning be kept, as aforesayd, which is, that how many degrees I doe take of altitude with my Balestila, or other instrument: these haue I raised the Pole, not aboue me, but aboue my Horizon, and the selfesame degrees am I distant of the Equinoctiall line.

The

The fourth Chapter, of the North ſtarre, of the guardes and of his moouing.

The North ſtarre being very well ſeene and knowmen of all the Saylers, is the firſt of the ſeuen ſtarres, which the Vrſa minor doth ſet in order, and commonly hee is called Bozina. Theſe ſeuen ſtarres doe ſeme cleare and bright, and three of them are like to a halfe circle, and the other 4. like to a quadrangle in this manner.



The

The ſeuen ſtarres doe alwayes moue rounde about the Pole, deſcribing their circles from the Eaſt into the Weſt, and alwayes in one ſelfe ſame diſtance one with the other, and in euery foure and twenty houres they giue a turne about the Pole. But as the north ſtar is more neere the Pole, then any of the others, his turne is leſſer and done with more leiſure, then any of the other ſtarres: becauſe how much more euery ſtarre goeth farther of from the Pole, ſo much the greater circumference hee maketh, and ſo much the haſter he moueth. Therefore I ſay, that by this ſtarre of the North is knowne, how much the altitude is, which the Pole hath vpon the Horizon: In ſuch ſorte, that although the Pole is ſeene, yet by this ſtarre is knowne the place where the Pole is, the which is knowne by another ſtarre of the ſame ſeuen, the moſt ſhining. Of the two called guards, which are in the moneth of the Bosina, which ſtarre is called the formeſt guarde, and alſo he is called the Horologiall ſtarre, becauſe he goeth alwayes like to a whele of a cloak, giuing to vnderſtand in all times of the yeere, what houre of the night it is, by that reckoning, that is called in the middeſt of Aprill, midnight in the head. And note yee, that betweene the North ſtarre, and the guardes, is alwayes the Pole, in ſuch ſorte, that when the guarde is aboue the Pole, the North ſtarre is vnder, and ſo contrarie, ſeeing by the courſe or place where the guardes are, is knowne to what parte of the Pole, and in what diſtance of him, the ſayd ſtarre is.

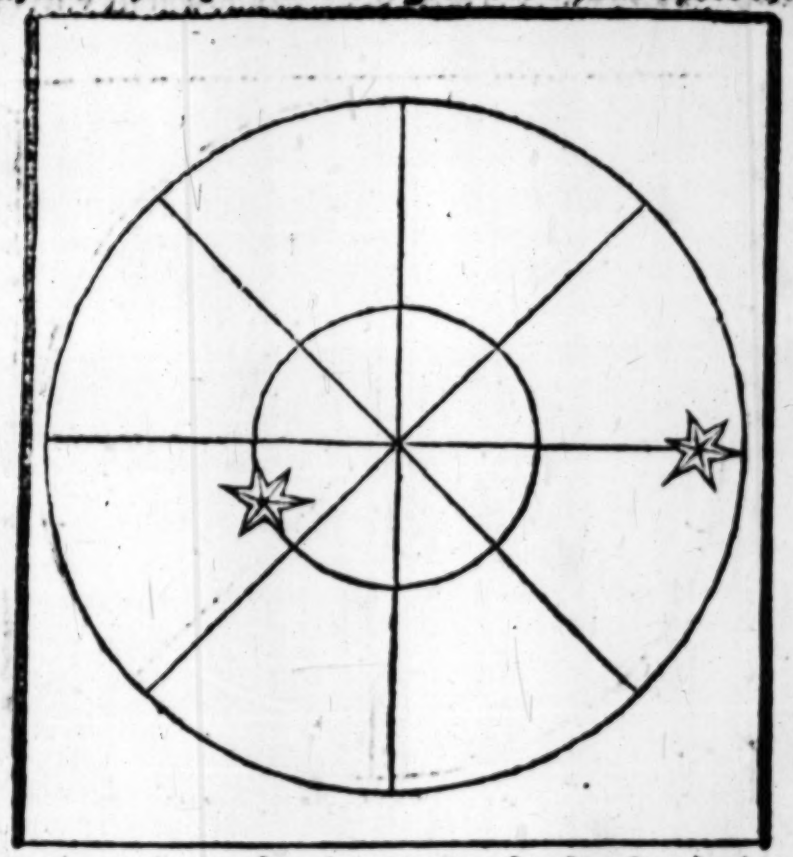
The fifth Chapter, howe that according to the courſe wherein the guardes are, is knowen how many degrees the North ſtarre is vnder or aboue the Pole.

IT hath beene declared in the chapter going before, that the North ſtarre mooueth himſelfe rounde about the Pole, and that likewiſe the two ſtarres called the guardes, doe make their mooving rounde about the ſayd ſtarre, and of the Pole. By the which it is neceſſary to know, in what courſe the guardes are in, with the ſayde ſtarre, becauſe with this, will bee knowne by the rules here vnder written, in what courſe the ſayde ſtarre is in with the Pole, as alſo howe many degrees hee is vnder or aboue him: for the which knowledge, the rules following are to bee looked on, in the which is to bee noted that beſides the rules of the principall windes, you ſhall find rules for the halfe partes, becauſe the ſayd altitude more eaſely at any houre of the night may be taken.

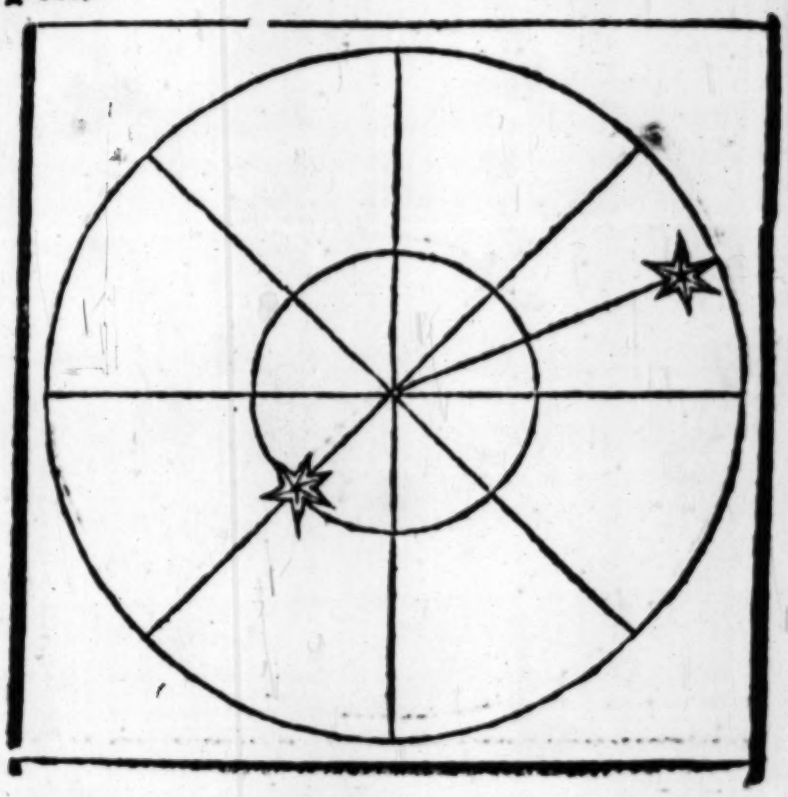
The which rules goe ſet with their figures in ſuch ſorte, that in euery courſe that the guardes are in, may be knowne likewiſe in what courſe the the ſayd North ſtarre is in: it is ordained in the manner following.

The

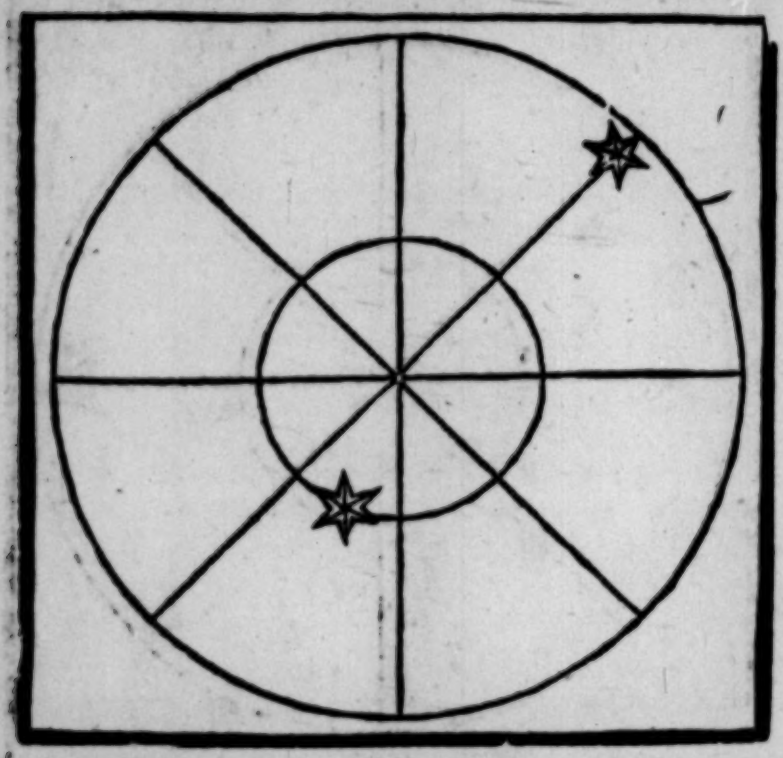
The guardes in the East, the formost guarde is with the North starre, East and West, and the sayd starre a degree and a halfe vpper the Pole.



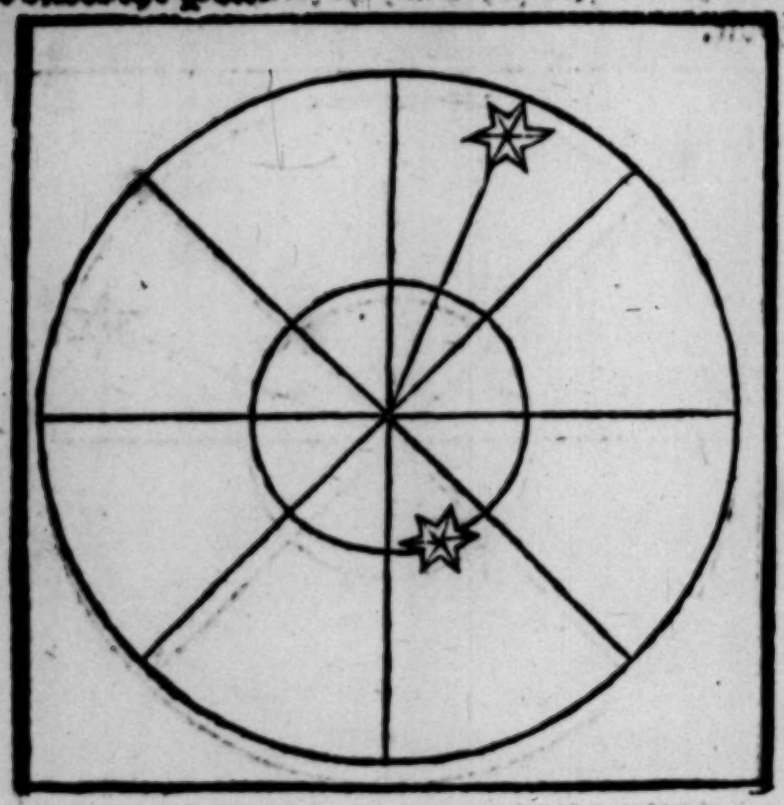
The guardes in the East, North East, the North starre is three degrees vpper the Pole.



The guardes in the Northeast, the vtte guarde is with the other East and West, and the North starre is three degrees and a halfe vnder the Pole.

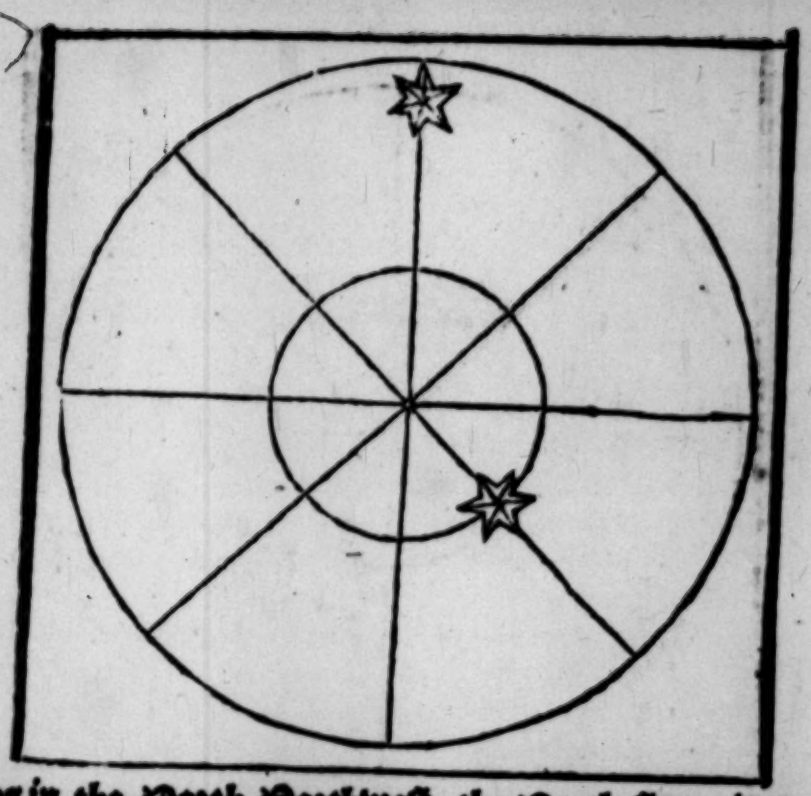


The guardes in the North Northeast, the North starre is three degrees and a halfe vnder the Pole.

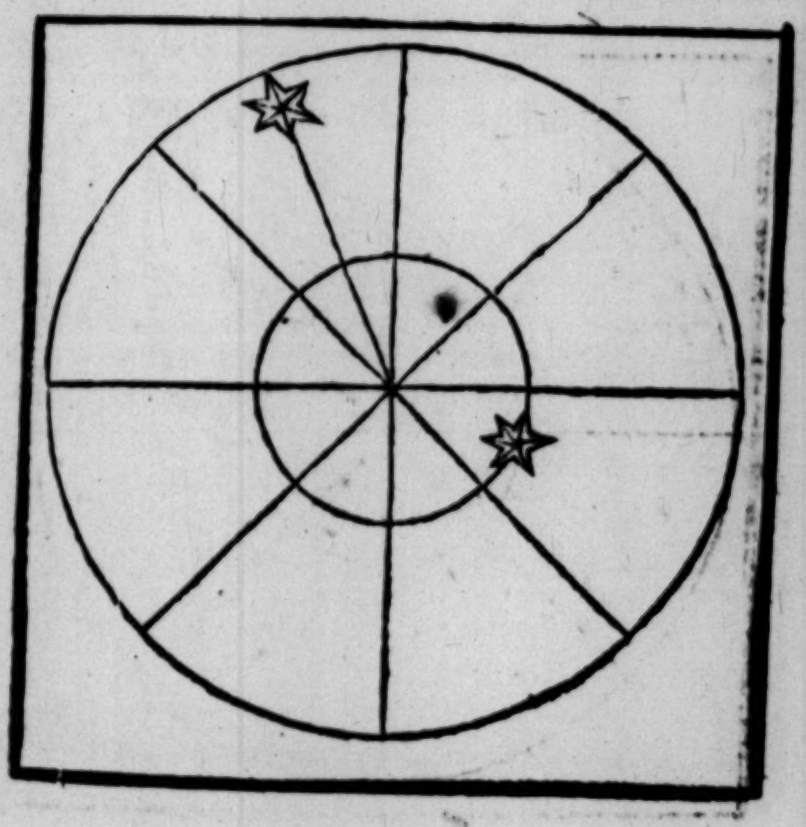


The

The guardes in the North, the foremoſt guarde is with the North ſtarre North and South, and the laſt ſtarre is three degrees under the Pole.

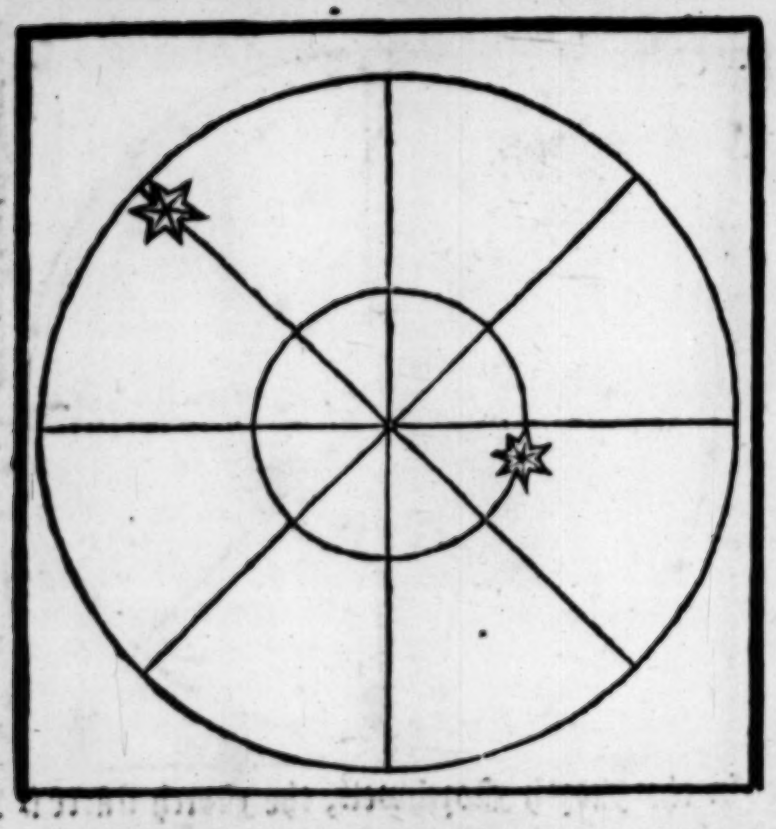


The guardes in the North Northweſt, the North ſtarre is two degrees under the Pole.

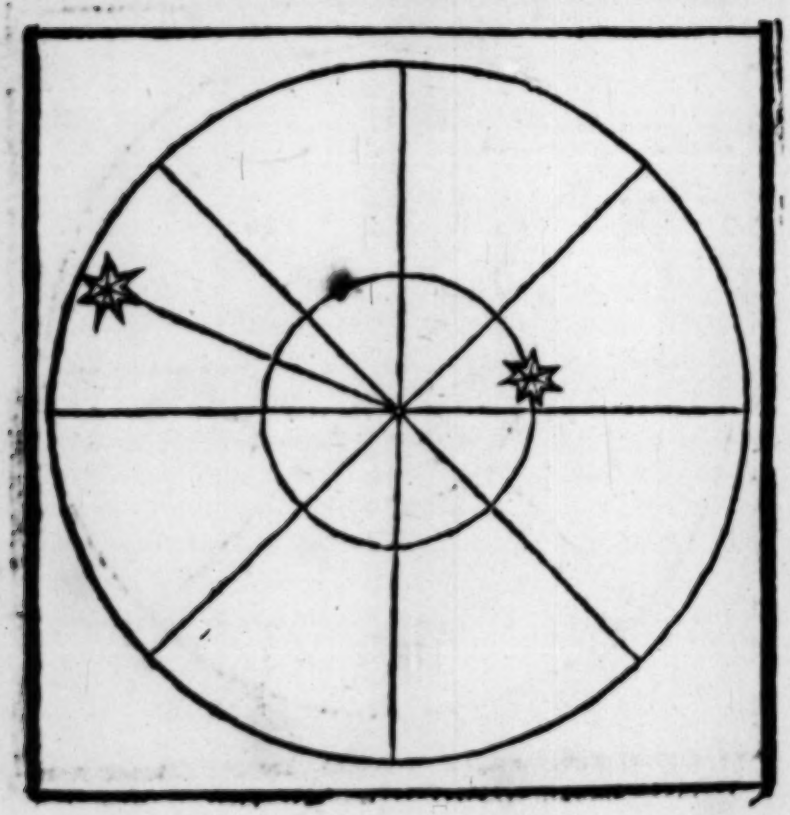


The

The guardes in the Noychwest, the one guarde is with the other Noych and Nouth, the lays starre is halfe a degree vnder the Pole.

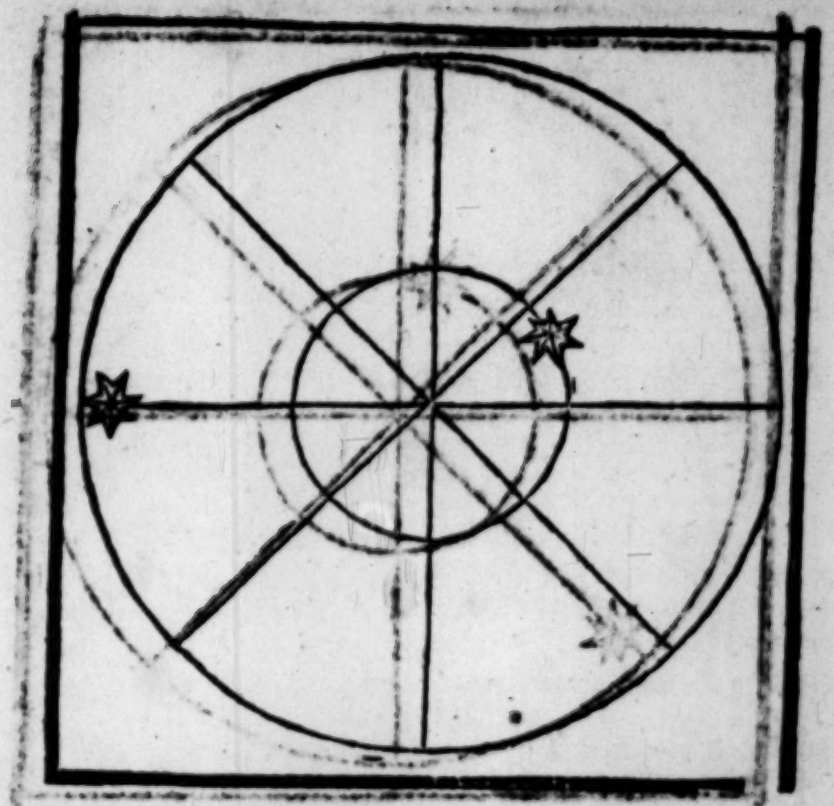


The guardes in the Weſt Northwest, the Noych starre is one degree aboue the Pole.

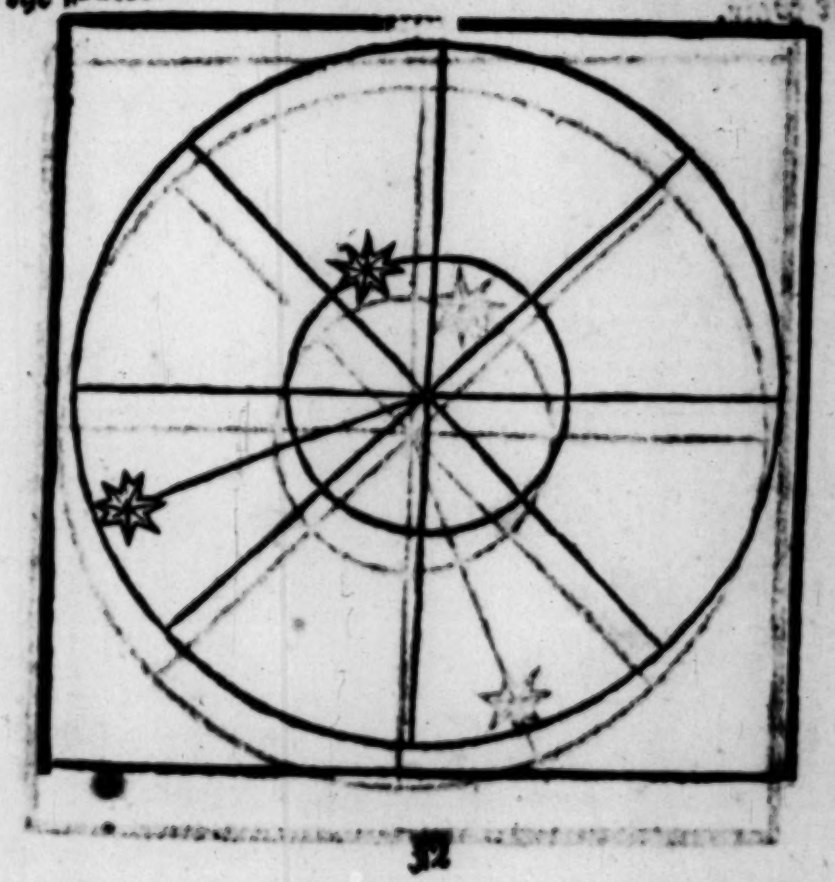


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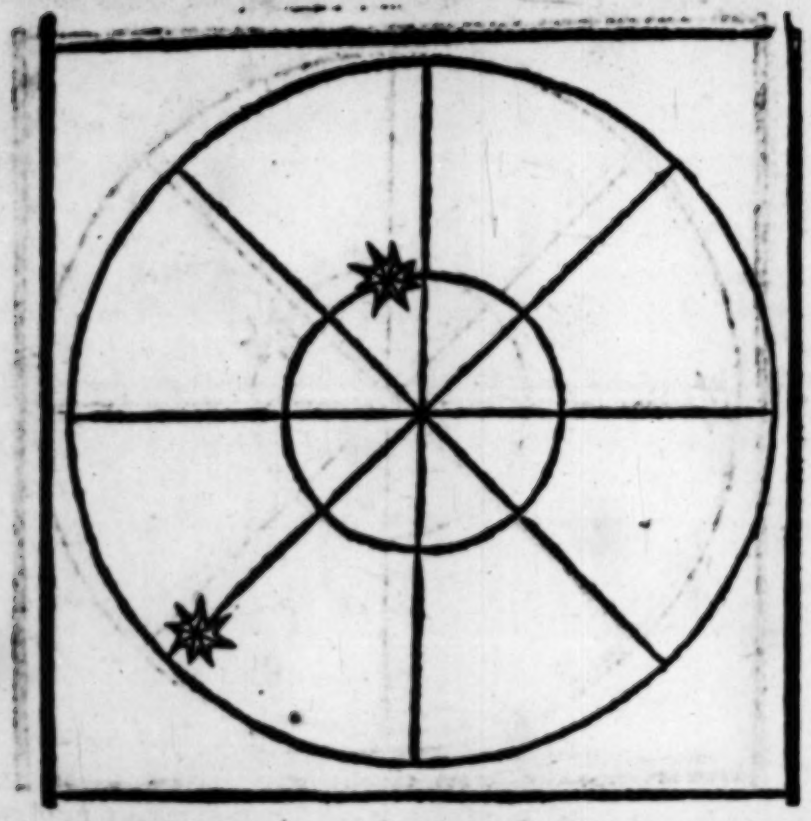
The guardes in the East, the Septentrionall guarde is with the Pointers Tayle East and West, and the Sun is farre in a degree and a halfe aboue the Pole.



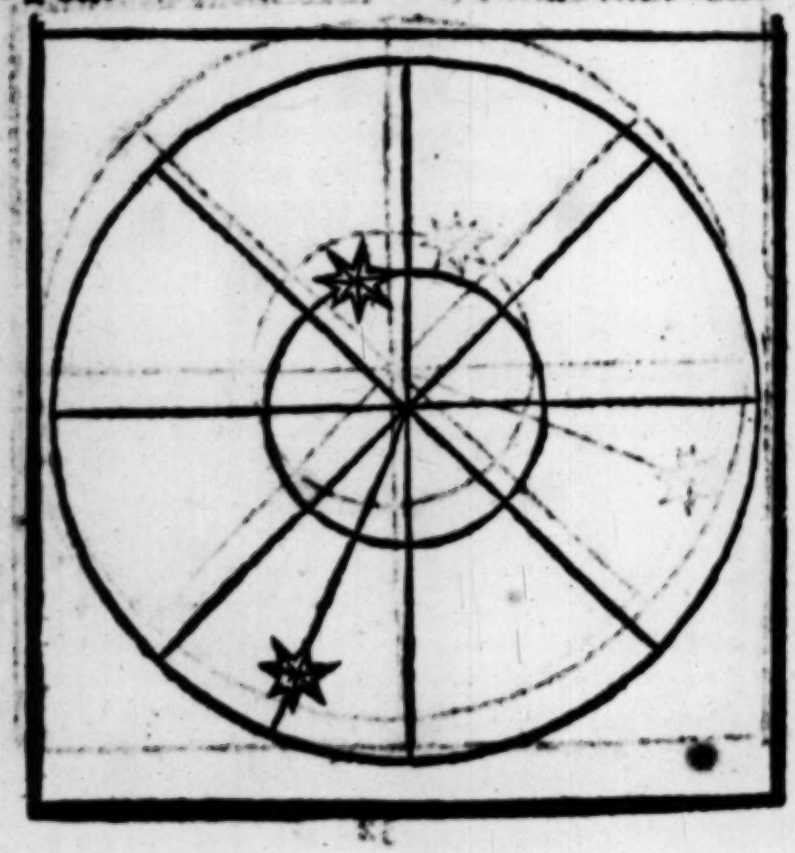
The guardes in the West Southwest, the North starre is three degrees aboue the Pole.



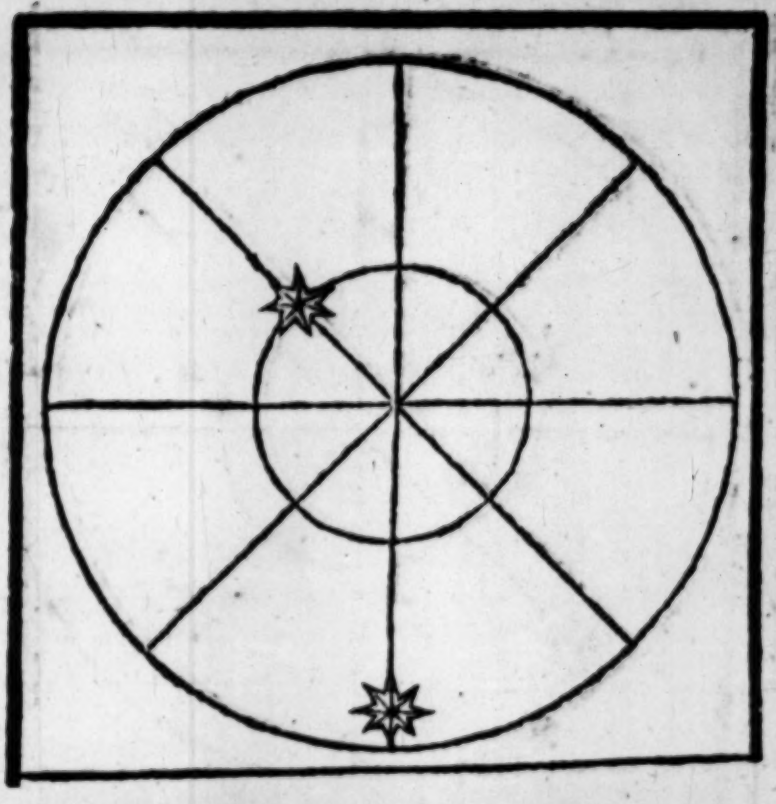
The guarres in the Southweſt, the one guarre is by the other Eaſt and Weſt, and the North ſtarre is three degrees and a halfe aboue the Pole.



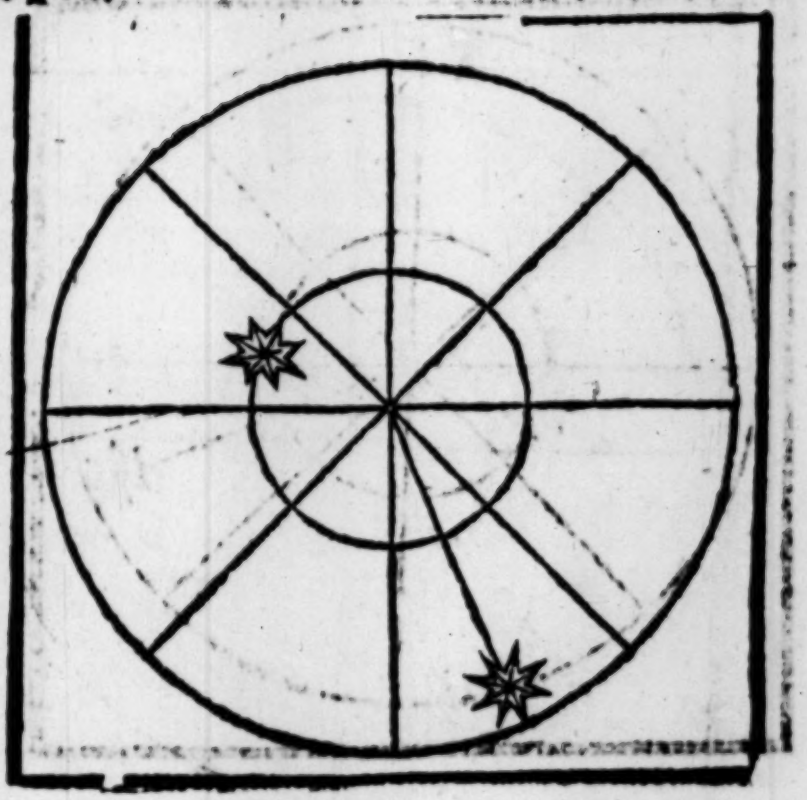
The guarres in the South Southweſt, the North ſtarre is three degrees aboue the Pole.



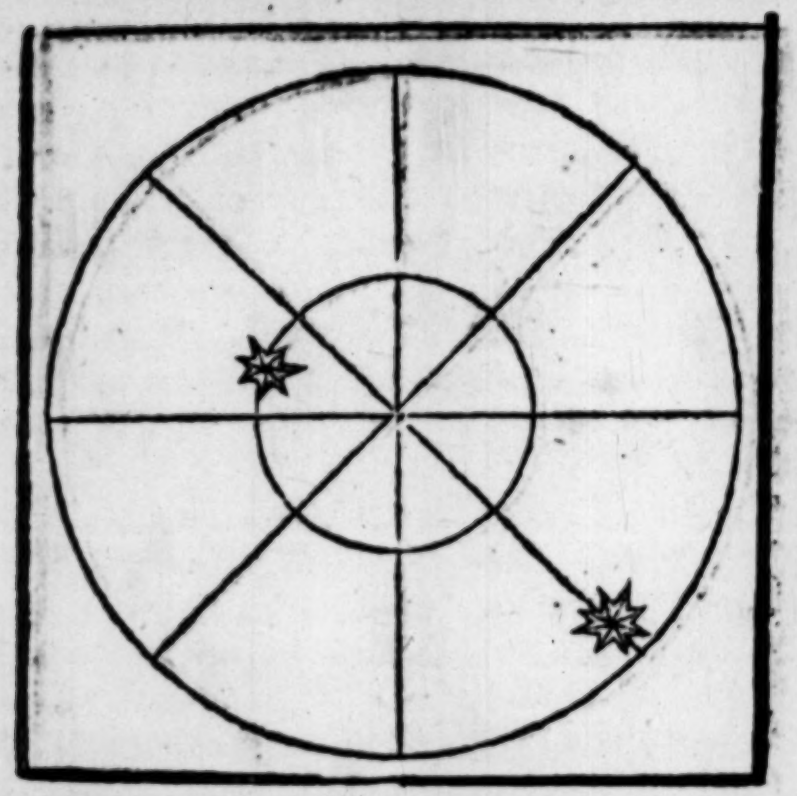
The guardes in the South, the North starre is with the seconde guarde.
North and South, and the sayd starre is three degrees aboue the Pole.



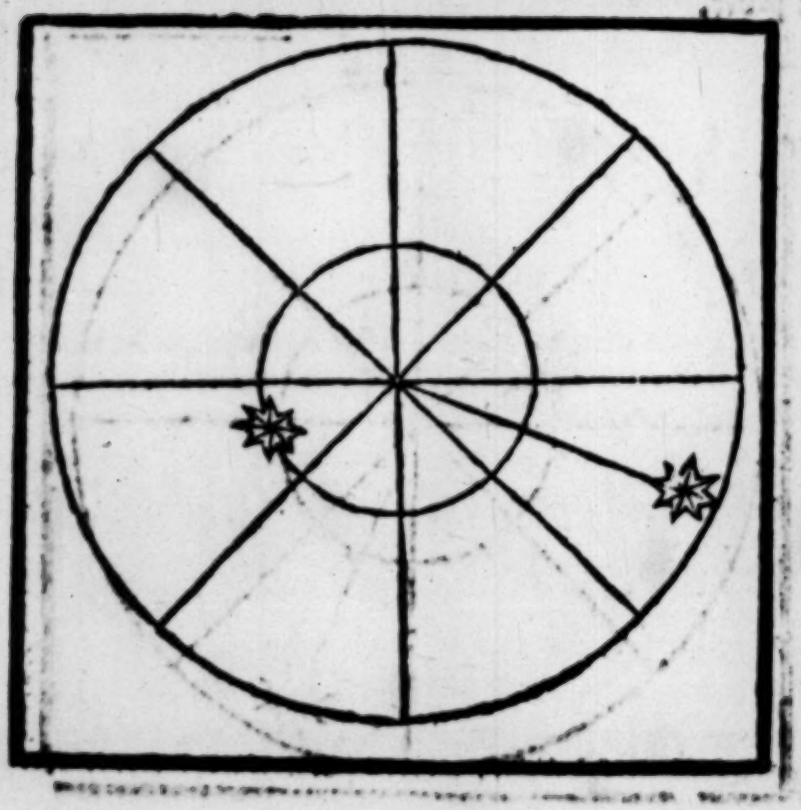
The guardes in the South, South east, the North starre is two degrees a-
boue the Pole.



The gemow in the Southeast, the one gemow is by the other Mouth and South, and the Mouth starre is about 2 degrees above the Pole.



The gemow in the East Southeast, the Mouth starre is halfe a degree under the Pole.



The sixt Chapter, howe the rules of the altitude of the North starre ought to be applied, and howe they ought to be put to, or taken away, according to the place where the guardes are.

THerefore when you take the altitude of the Pole, looke in what place the gaurdes are, and by them you shall vnderstand if the North starre bee vnder or aboue the Pole, as it is sayd. And marke, if the starre be vnder, you shall ioyne with the altitude that you take, those degrees that are vnder and altogeather so much is your altitude: and if the starre bee aboue the Pole, you shall take away from the altitude that you tooke, the degrees that the starre is aboue, and that which remaineth, is the altitude wherein you are.

An example.

I say the guardes bering in the Northeast, you tooke xl. degrees of altitude, ioyne with these xl. three degrees and a halfe, that the starre is vnder the Pole, which doth amount to fortie three degrees and a halfe, then is your altitude: and if the guardes be in the Southwest, take away of the fortie degrees three and a halfe that the starre is ouer the Pole, there doth rest thirtie fiue and a halfe, and this is the altitude wherein you are: so that when the starre is vnder the Pole, you shall ioyne with the altitude those degrees that he is vnder, and when hee is aboue, you shall take away the degrees that he is aboue, and so you shall make your account iust, and you shall know the place where you are.

The seuenth Chapter, wherein be declared certaine doubtes that in this moouing of the North starre may be had.

IN the third Chapter of this fourth Booke hath beene said, that the starrs which are neere to the Pole, do moue themselues more slowly then they that are farre off, and it seemeth that of this may bee a doubt, because that euerye thing which mooueth their partes in rule, do moue so equally, that one mooueth not more slow, nor the other more hasty. And as all the heauen doth moue equally, as the sight doth manifest it, and so is the beginning of Astronomie, that the moouing of euery day is the rule whereby it ought to be said, that the partes of heauen doe moue equally, and not the one parte more slowly then the other. Likewise this is proued because that one selfe intelligence, mooueth all the circle and all his partes, seeing that the partes nearest to the Pole, are lesse then those which are farre off, therefore the sayd intelligence hath a greater proportion vpon them, and of the great proportion commeth greater swiftnes, whereby may bee sayde that

the partes which are most neere to the Pole, do moue more speedily or with more hast then the others.

Item, in the fifth Chapter of the first Booke hath beene declared howe the heauen is round, and seeing that it is so, it may be saide, that in the heauen is no parte from aboue the Pole, nor parte vnder the Pole, because all round bodies, naturally haue no parte high or lowe: for if one parte where more high or low then the other, then the body should not be round, whereby it seemeth, that it cannot be said, that the starre of the North, nor the guards are in no time vnder or aboue the Pole.

The third doubt is, that likewise we say, that the North starre doth giue an equall turne rounde about the Pole, and seeing it is so, that it is equall: wherefore at some times is hee distant of the Pole vnder or aboue halfe a degree, and at other times three degrees and a halfe.

To that which is said in the first doubt, all the Philosophers and Astronomers are against, for that all of them holde that the Pole mooueth not, but is fixed, and vpon him all the partes of heauen doe mouc in circle maner, and in such sorte, that that which is neere, mooueth slowly, and that which is farre of, mooueth with more hast, whereby that which mooueth it selfe by the Equinoctiall, because that there it is farthest of, there the moving is more swifte then in any other parte, and this sheweth it selfe by experience. We see in the mooving of a wheele, that the Ex standeth still, and alwayes remaineth in one place, and all the partes of the wheele doe compasse it about, if the which, those partes that are neere to the Ex, goe more slowly, and those that are farther of, moue with more swiftie mooving, so the vppermost parte of the wheele his mooving is more swiftie then any of the other partes: as Aristotle sheweth it in the Mechanica.

To that which is sayd, that the heauen moueth it selfe equally, it is to be vnderstood in equalitie of time, but not in equality of place, in such sorte, that in equall time they make their partes in equall mooving, because these partes cannot of continuance moue place by themselues. A continuance is that whose mooving is one, and is to be vnderstood wholy together: so that it cannot be, that at one time one parte is mooued, and at another time another, but at the mooving of one parte, all the other partes, and all together are mooued: so that when the Heauen mooueth, because his mooving is a pure mouing, of his place to his mooving all the parts doe moue place.

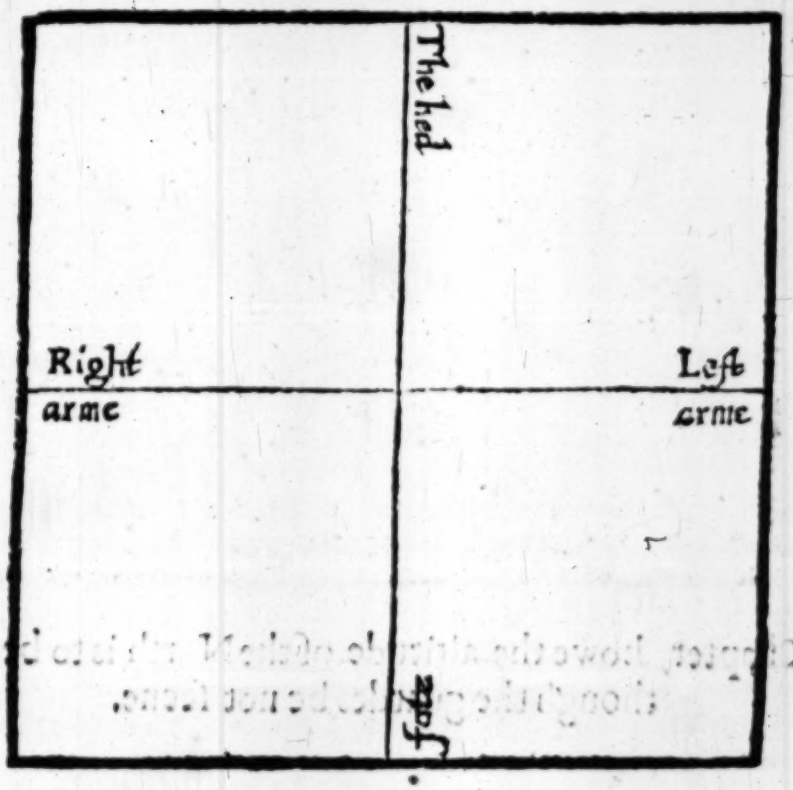
Item although that one selfe intelligence doe mooue the partes of the Poles and likewise of the others, which are more distant because all be continuall, they are mooued togeather. And it is so, because these partes are not put asunder, nor deuided the one from the other. And if they were it is certaine that the lesser partes should mooue more swiftly then the greater partes, the which is not because the sayd inteligence doth mooue them

together

together, and the mouer hath his proportion to all, and not to part.

And this is manifest, because in the continual moueable, there are parts of an infinite smalnes, for that to any part ẏ is marked may be giuen a lesser.

To the second doubt which is in the rounde bodie, that there is no parte high nor lowe: truth it is, that naturally there is not, respectiuely there is. And to say that the North starre is sometime aboue the Pole, and at other times vnder, it is to bee vnderstood, not naturally, but to our respect, and so he that were in such a place, that had the Pole for Cenith: the North starre should not bee from him more high nor more lowe, at one time then at another. But to him whose Cenith is not vnder the Pole in the mouing which the starre maketh at some time, he will be vnder the Pole, and at other times aboue: and to know howe the North starre is vnder or aboue the Pole, doe you imagine the figure of a man in the Pole Article, which hauing his face towardes the middest of the day, and being so put, the left arme shall be towardes the East, and the right towardes the West, therewhen the North starre doth goe from the left to the right, which is from the East towardes the West by the heade which maketh the halfe of this circle, we say that he is aboue the Pole, because then the Pole is betweene the starre and the Horizon, so there are more degrees, from the Horizon to the starre, then to the Pole: and when he goeth from the right arme to the lefte, which is from the West to the East, in the other halfe turne that hee maketh by the foote, wee say, that hee is vnder the Pole, because then the starre will be betweene the Pole and the Horizon, and then there are more degrees from the Horizon to the Pole, then to the starre, as appeareth by this figure.



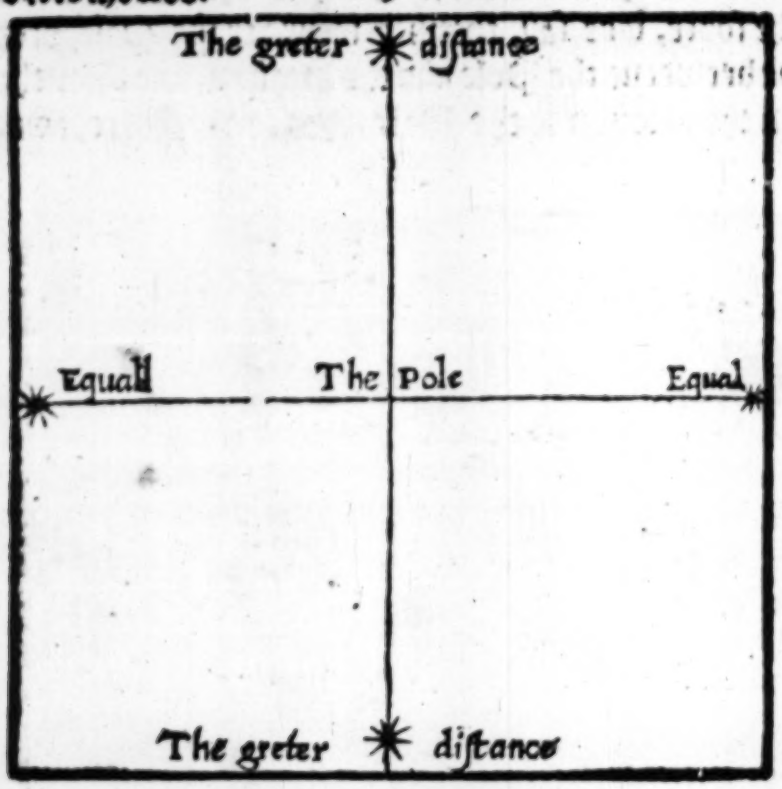
And so it is to bee vnderstoode, that the North starre to bee vnder or aboue the Pole.

To the third is to be noted, that the North starre doth goe round aboute the Pole, but although the turne, which he giueth, be equall in roundnes, he goeth distant from the Pole, more in one place then in another, this is to be vnderstood not as much as toucheth the roundnes, but as much as toucheth the straightnesse of the Pole, in this manner.

When the starre is in any of the armes of the East, or of the West, then he is neither more high nor more lowe then the Pole but in one equallitie with him.

And for as much as toucheth his turne, hee goeth from the sayde armes, by the parte of the head, or by the parte of the foote, so much he goeth aside of, from the straightnesse of the Pole. In such sorte, that when hee is in the head, is, when he is farthest of the Pole, by the vppermost part: and when he is in the foote, is, when he is farthest of by the lower parte, the which is not to be vnderstoode, that the circumference is greater in the heade or the foote, then in the other partes.

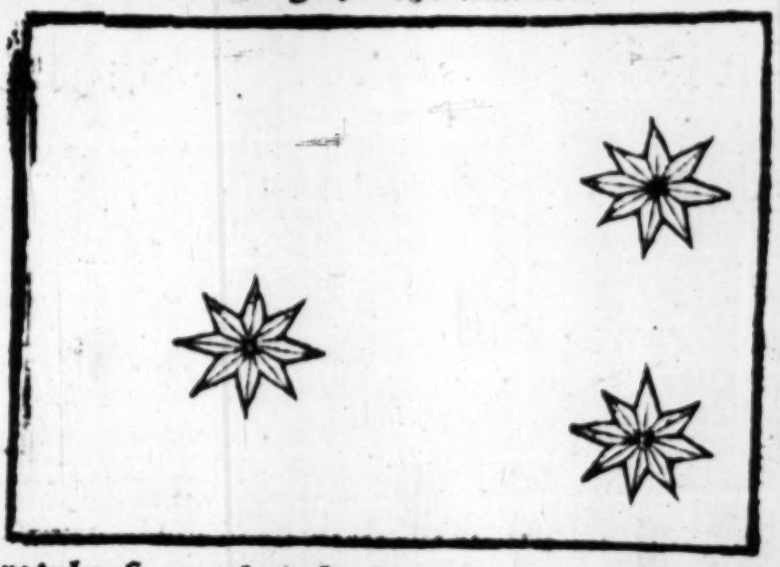
But vnto our respect is that which hee goeth distant aboue or vnder the Pole, as here it is shewed.



The eight Chapter, howe the altitude of the North, is to bee taken, although the guardes be not seene.

It

It happeneth many times to such as bee saylers, when they goe neere the Equinoctiall, by reason the Pole is neere to their Horizon, they see not wholy the curne which the guardes doe make, round about the Pole, so that when the guardes doe descend from the West, and goe towardes the East, in all those courses of the West Southwest, South West South Southwest, South, South Southeast, Southeast, East Southeast, they cannot take the altitude, because he is not seene when the guardes doe come to euery one of these sayd courses. And for this in this Chapter shall be declared, howe it shall be knowne, when the guardes doe come to euery one of these courses aforesayd, and taking the altitude howe much it is that iustly shall be taken away from the altitude, according to the place where the starre is, is to bee vnderstoode, that which is aboue the Pole: for the which is to bee noted, that besides the two starres which wee call guardes, which before haue beene spoken of, there are other three starres, which goe wel neere in the same distance, that the guards goe in, that goe round about the North starre: and although the guardes be not seene, yet by these three starres, or by any of them, the altitude of the Pole is to bee knowne, as well as by the guardes, which is to bee knowne in this manner. These three starres which before are spoken of, are called the third, the sixt, and the nienth, and although they haue other names, these names we name them by, because it maketh for our purpose, and the reason is, because the starre, which we call Tercera: or thirde starre, goeth three houres, which is one course or winde before the formost guarde: and the Sesta or sixe, two courses or windes which are sixe houres: and the Nouena or nienth, three courses or windes which are nine houres. And to knowe these starres, doe you note that the third starre hath neere to him other two starres, and all three doe make well neere one triangle, in this manner.



This starre whensoeuer that the formost guarde is in the heade, then is

she in the Northeast, and if the guarde bee in the West, then is shee in the Northwest, and if the gaurde be South. then is she in the Southwest, and so it is to be vnderstood of the other courses, that alwayes he goeth one winde behinde the guarde.

The first is one starre alone, the which goeth well neere as distant of the North starre as the gauardes.



This starre goeth two windes behinde the gaurde, so that if the gaurde be in the head, she is in the East, and if the guarde bee in the West, she is in the North, and so it is to be vnderstood in the other courses.

The nienth is one starre alone which is neerer to the North starre, then the guardes, this starre goeth three windes behinde the gaurde, so that if the guarde be in the West, she is in the Northeast, and so contrary.



And these three starres being knowne, although the guardes be not seene, by these or by any of them is to be knowne, in what course the gaurdes are in reckoning the courses in the manner, as it hath beene declared: the which rule I haue had experience of, and haue found it certayne.

The nienth Chapter, howe the altitude of the North, is to be taken, although the Horizon be not seene.

IT happeneth many times to such as sayle, that they cannot take the altitude of the North, because they cannot see the Horizon. This is because either the earth doth couer it, or some cloude or vapour which riseth of the water, or it maketh so much darkenesse, that it cannot bee descerned, or for some other cause. And howe to knowe the Horizon is a thing so necessary, that lacking it the altitude of the North cannot any manner of way bee taken with the Ballestilla, of this cause the saylers receiue verye great hurte, for that many times it happeneth to them, to passe many dayes without taking the altitude and most of all in the winter.

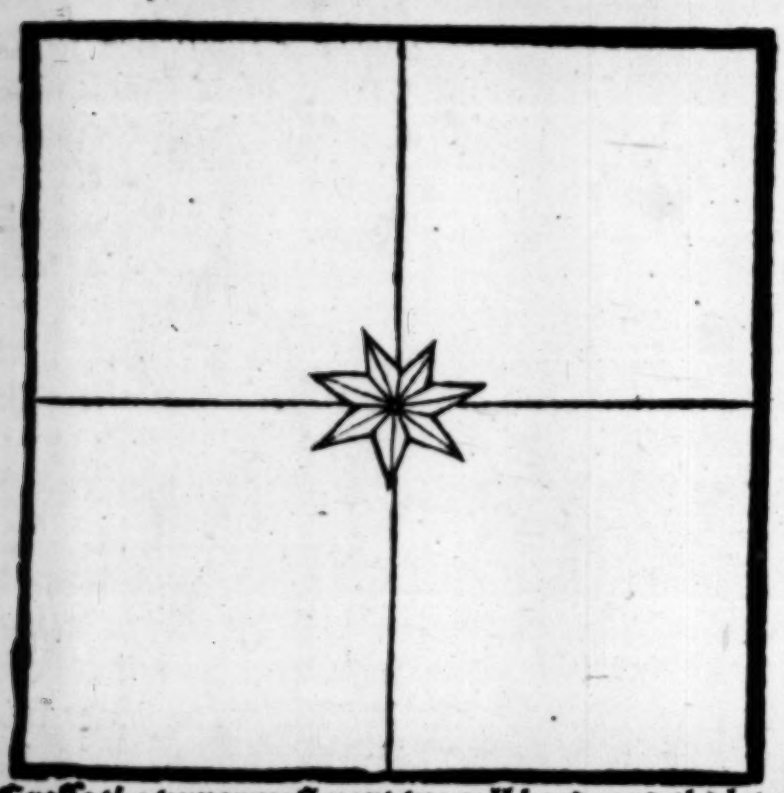
Therefore to take away this hurt and inconuenience, I will declare in this

this present Chapter, in what manner the sayd altitude may bee taken although the Horizon bee not seene, the which is this. The Pylot or other person, that shoulde take this altitude, let him take a staffe or rodde of the greatnes of a finger little more or lesse, and so high, that being put vpright in the grounde, it come iustly to his sight, and being made of this greatnes, no more nor lesse: let him make at the toppe of it a Crosse, and when he will take the altitude, let him ioyne his feete together, and laye downe the rod straight and equall from the poynt of his feete, as farre as the rodde will reach, and let him make two poyntes, the one where he hath his feete, and the other as far as the rod doth reach, and in that poynt where the rod doth reach, there doe you take him vp, and let some body hold him vpright, and the Baleshilla being taken his feet being put in the poynt that hee first had them put, let him take his altitude, making the Horizon in the highest parte of the rod or staffe where he marked the Crosse. And ye shall vnderstand that this is his Horizon, whersoeuer he findeth himselfe. And it is to be noted, that if the night were as darke, that the highest part of the rodde cannot be seene. That which I haue sayd is his Horizon, then put vpon the top of the rod, a signe or shew of fire, by the sight of the which hee may hit to put his Baleshilla right with the sayd rodde, and so hee shall take his altitude precisely doing in the rest, to take away or put to the degrees, according to the place wherin the guardes are, as before hath beene declared.

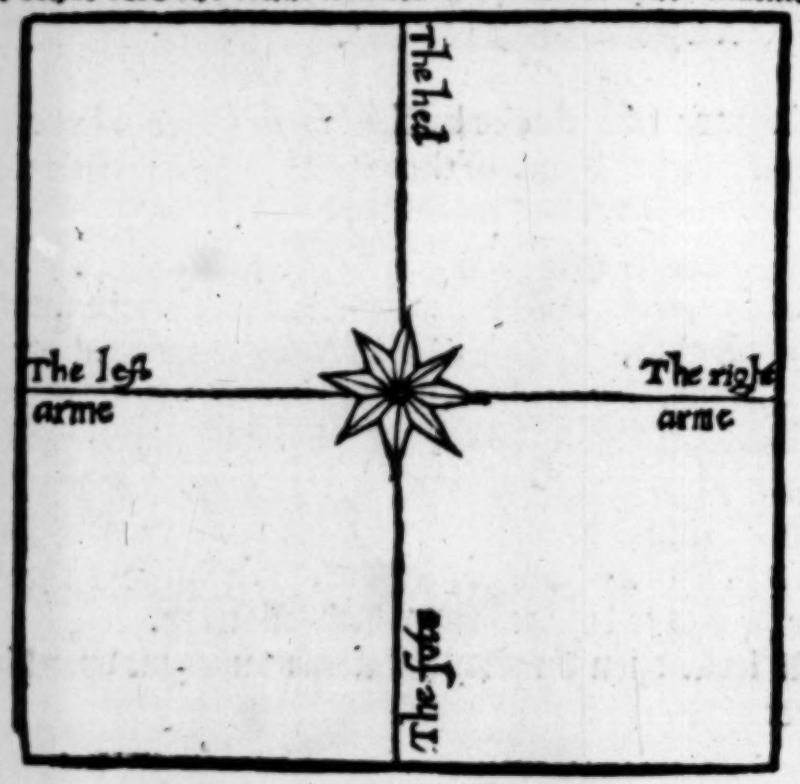
The tenth Chapter, of a clocke by the North starre whereby may bee knowne what houre of the night it is, in any manner of time and place that a man is in.

IN the thirde Chapter of this fifth booke, I sayde, that the formost guarde is called Horologiall, because hee goeth alwayes round about the North starre, like to the wheele of a cloke, giuing knowledge what houre of the night it is. And because this knowelenge bringeth much profite, and it is conuenient that euery one should knowe it, therefore in this present Chapter, I will speake howe it should be knowne in any manner of place, wheresoeuer a man is, and in any time of the yeere, what houre of the night it is, and for to knowe it, is to be noted that which followeth.

First of all, looke vpon the North starre and imagine vpon him a Crosse in this manner.

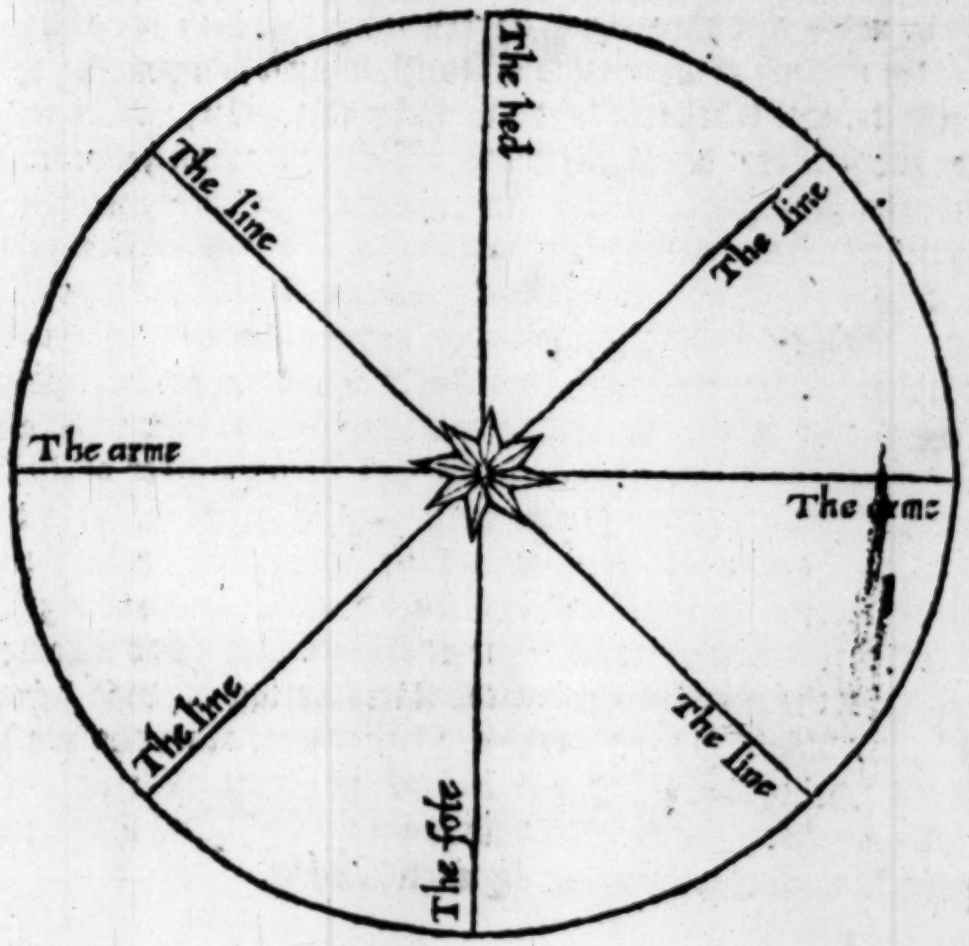


Of this Crosse the vppermost part, we call head, and the lower most part foote, and the other two the right arme, and the left. in this manner.



This being had, is to be vnderstood, that betweene these foure courses or streekes, wee put other foure which doe deuide or parte these in the middest which we call lines, in this manner.

So

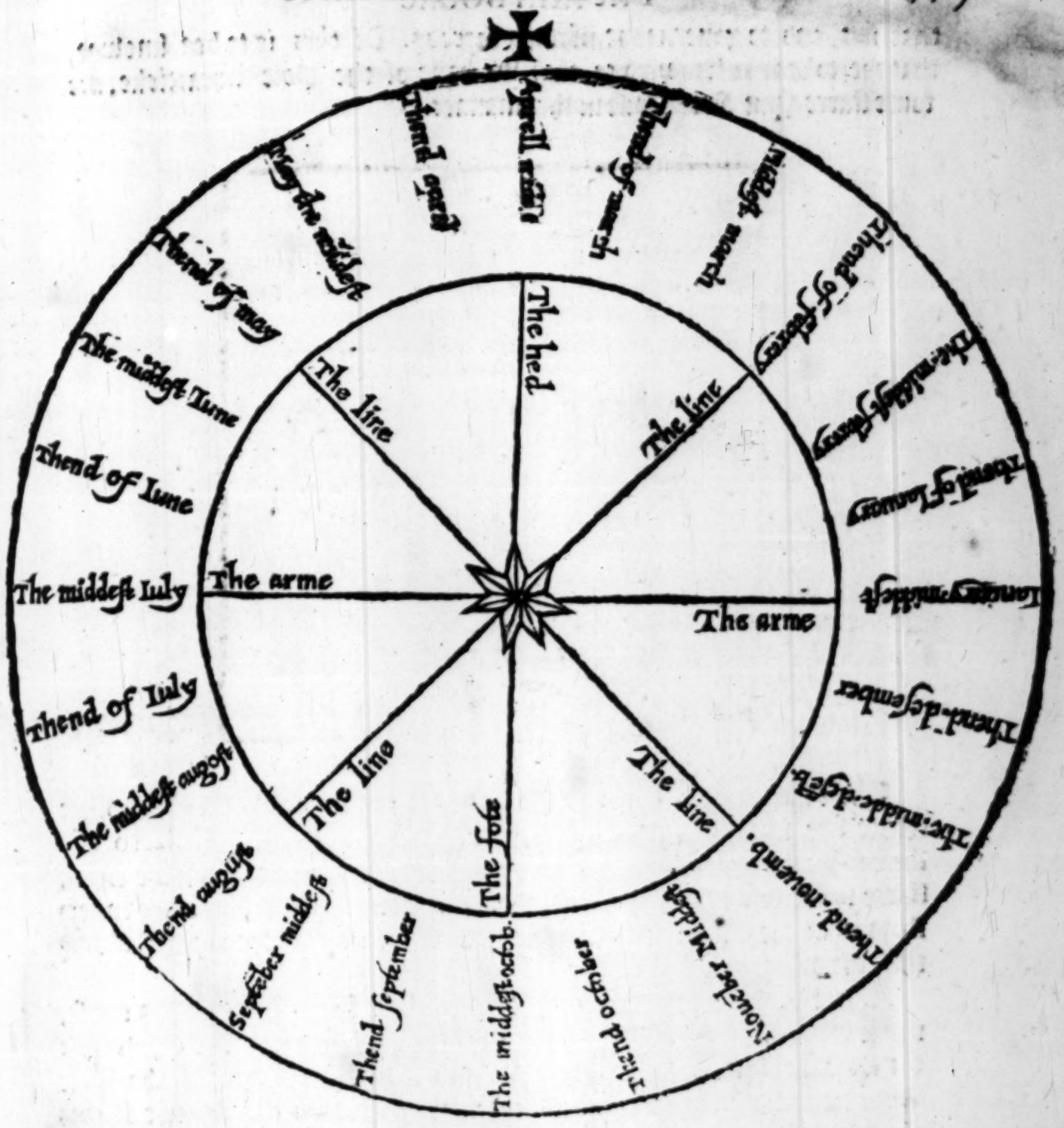


So that there is a line betweene the right arme and the heade, and a line betweene the heade and the left arme, and a line betweene the left arme and the foote, and a line betweene the foote and the the right arme: this imagination being made, it is to bee vnderstood, that the greater starre of the two guardes, which is the formost, which before hath beene named the starre of the clocke, this starre in twenty foure houres doth passe these eight partes, tarrying three houres from the one to the other. So that if at xii of the clocke in the night, he be in the head, at three hee shall be in the line betweene the heade and the left arme, and at fiue in the sayde arme, and in that sort the rest is to be reckoned.

Of this doth remayne, that being knowne in what parte this starre should bee when it is midnight, foorthwith will be seene, that if hee be there it is mydnight, and if hee bee not come thither it is not, and if he bee past, it is more then mydnight. For this it is necessary to know two thinges: the one is, to knowe in euery moneth of the yeere, in what parte the guarde starre

ought.

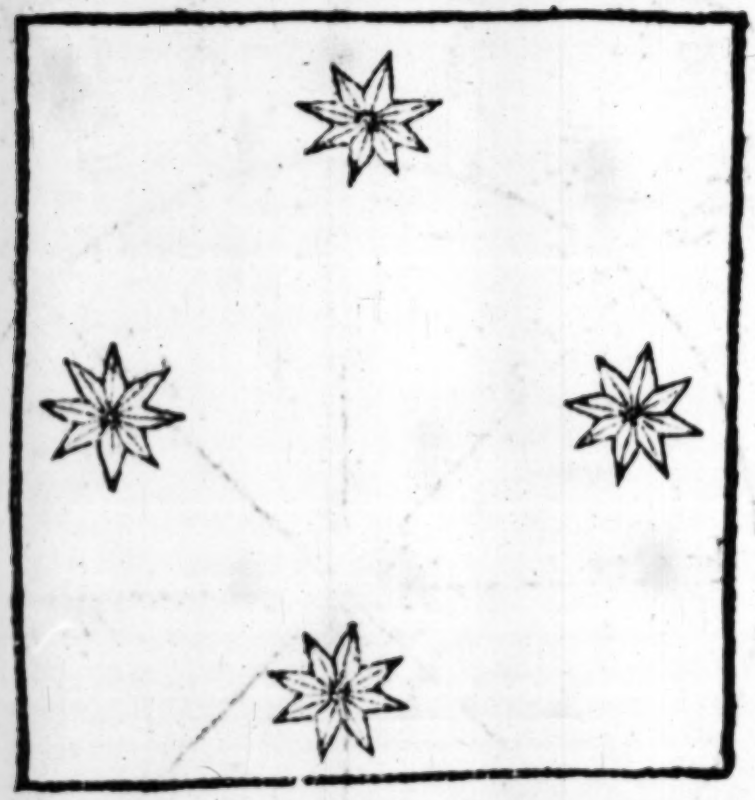
ought to bee in, to knowe when it is mydnight: and the other, howe it is to be knowne, what houre it is, moze oz lesse then mydnight. Of the firste this is to be noted, that the account oz reckoning, that is to bee vsed in this, is, that at the middest of the moneth of Apzill, when it is mydnight, then the sayd guarde starre will be in the heade, with the Nozth star, and from thence forwarde euery fifteene dayes, the middle of the night, is one houre forward: for in euery day he goeth forwarde foure poyntes oz minutes, and giuing to euery houre threescoze poyntes, so that it commeth to passe in euery fifteene dayes one houre forward. But in this I say that I haue made experience sometimes with clockes of prycise houres, and setting them punctually, at the poynt that the Sunne setteth, and I finde that vnto the twentie day of Apzill, the guarde and the starre, doe come pzecisely at mydnight in oppositte, but because the difference is little: I doe follow the ozder of the figure following. To the second is to be noted, as before hath beene declared, that in euerye three houres the starre called the guarde, doth passe from one course to another, by the which there is to bee deuided with the imaginatiue, that space in three partes, and euery parte of space will bee one houre. In such sozte, that the place of the guarde starre beeing knowne where hee should be at mydnight, is to be knowne, if he be there, oz if he be one houre, two, oz three, behinde oz before, and so it will be knowne what houre it is: and to knowe what parte the guarde is in at mydnight, euery halfe moneth of the yeere, it must be seene in this figure following.



The eleuenth Chapter, howe the altitude of the Pole Antarticke ought to be taken.

SEeing there hath beene declared the altitude of the Pole Articke, or North with his demonstrations, it is conuenient to speake of the Pole Antarticke, how he should be knowne, because the saylers or any other person finding himselfe towarde the South parte, they may knowe howe to take

take him, and to gouerne themselues thereby. Of this is to bee knowne, that the tokens or knowledge, that we haue of the Pole Antarticke, are foure starres, put Crosse wise in this manner.



These starres be not any of the signes of the Zodiacke, nor of the other thirtie fire images of the heauen, therefore they are called Cruzero, and these foure starres we name, heade, foote, and armes, and to knowe which starre is the heade, and which are those of the other partes, is to bee vnderstood, that the starre of the foote is greater then any of the others, and by this, the other are knowne.

Therefore it is to be noted, that when these foure starres are a crosse, the heade being right with the foote, that then the greater starre which is the foote, is more neere the Horizon, and then hee is distant of the Pole Antarticke thirtie degrees aboue the sayd Pole, and the altitude of this starre is taken, and of no other: And he is to be taken when hee is in right of the heade, for there is his owne place. Therefore when you will know the altitude of the sayd Pole, doe you stay vntill the starre of the foote, bee in his place, because with the mouing of the heauen, he mooueth with the others, and being in his place, then take his altitude euen as you take that of the North, and looke that the altitude which you take of him, either they must be thirtie degrees or more or lesse, if they bee thirtie iust, you are in the Equinoctiall: If they be more then thirtie, those which are more, you are distant of the line towardes the parte of the South, and if they

they be leſſe then thirtie, that which is leſſe you are diſtant of the line towardes the parte of the Noꝛth.

An Example.

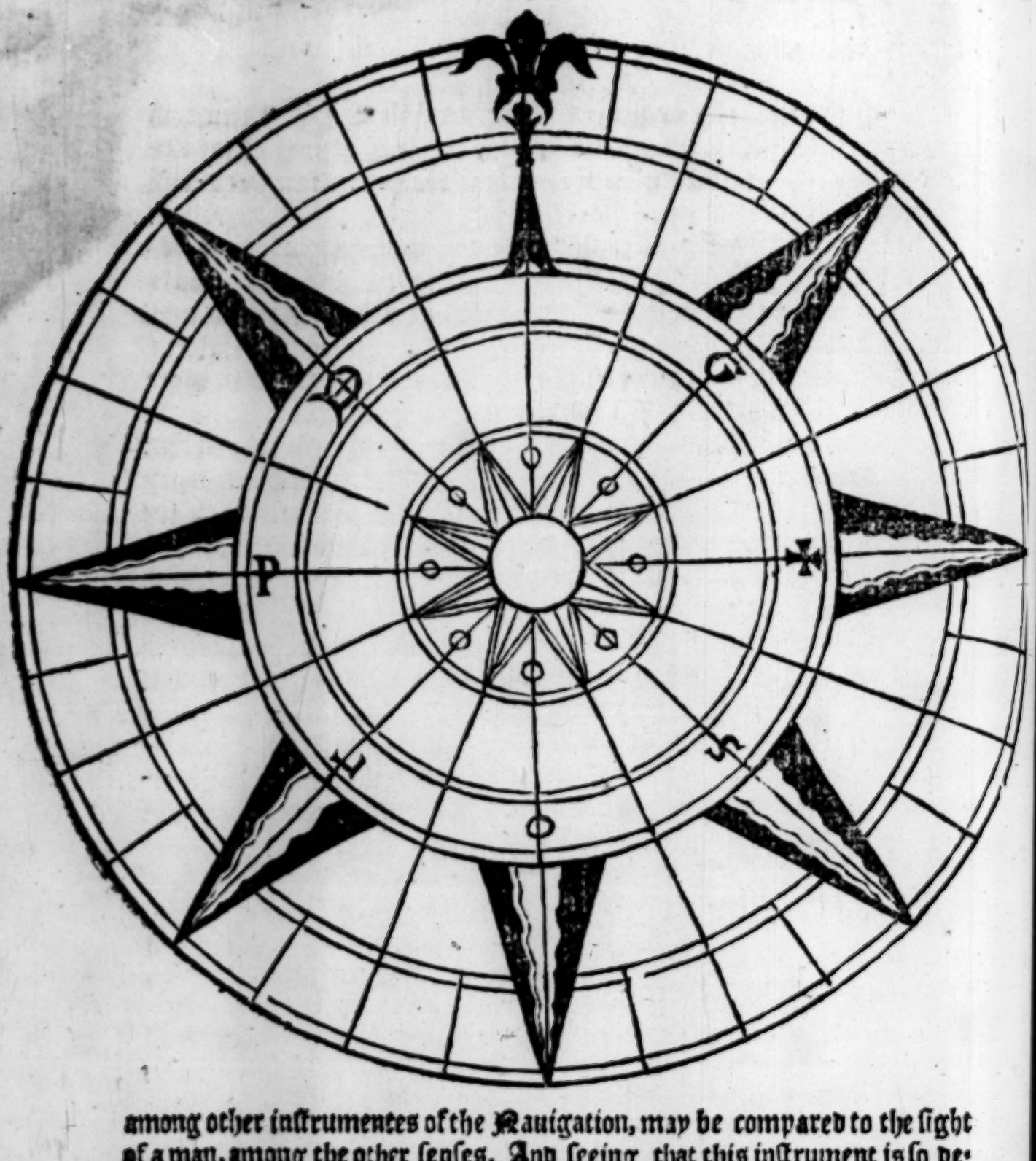
I ſay that the ſayde ſtarre being in his place, I tooke his altitude in foꝛtie degrees, then I ſay that I am in teene degrees, diſtant of the line towards the part of the South, the reaſon is, becauſe this ſayd ſtarre hath 30. degrees of declination oꝛ diſtance of the pole, therfoꝛe if I had taken him in the ſayd thirtie degrees, then ſhould I haue had the Pole in the Hoꝛizon, and hauing the Pole in the Hoꝛizon, I am in the Equinoctiall, and ſo the degrees, which are moꝛe then thirtie, in the which I tooke the altitude thoſe am I diſtant of the line towardes the parte of the South: foꝛ thirtie from the ſtarre to the Pole, and tenne from the Pole to the Hoꝛizon, are foꝛtie, in ſo many tooke I the altitude, ſo that theſe teene degrees, is the Pole rayſed aboue my Hoꝛizon, ſo that by howe much, I ſhall be diſtant of the line, ſo much the Pole ſhall riſe vp aboue my Hoꝛizon, and in ſo many moꝛe degrees, I ſhall take the altitude of the ſayd ſtarre and the thirty being taken out, which the ſtarre is aboue the Pole, thoſe which are moꝛe, I am diſtant of the line towardes the ſayd Pole, and ſo many ſhall the ſayd Pole be rayſed aboue my Hoꝛizon, and if I ſhould take the altitude in twentie, I am diſtant of the line teune degrees towardes the parte of the Noꝛth, and if I ſhould take him in tenne, I am diſtant twentie, and if I ſhould take him in fiue, I am diſtant twentie fiue, and if I had the ſayd ſtarre in the Hoꝛizon, I am diſtant thirtie degrees of the ſayde line, towardes the parte of the Noꝛth, ſo that when I ſhall take him in thirtie degrees, I am in the Equinoctiall, and when in leſſe, towardes the parte of the Noꝛth, and when in moꝛe, towardes the parte of the South.

The end of the fifth booke.

Tht ſixt booke, of the Compaſſes to ſayle by.

The firſt Chapter, of the Compaſſes to ſayle by, and of the deffectes which they may haue, and how they may be amended.

THe inſtrument that moſt pꝛeciſely and with greateſt perfection, the Pylot ought alwayes to haue, is the Compaſſe to ſayle withall, foꝛ that no inſtrument ſo much as this doth ſhewe the way, that he ſhould make. And likewiſe becauſe the other inſtrumentes, without this are to little effect, and this without the others doe pꝛofit much: and ſo the Compas



among other inſtrumentes of the Nauigation, may be compared to the ſight of a man, among the other ſenſes. And ſeeing that this inſtrument is ſo delicate and ſubtile, it happeneth that for ſmall occaſion he commeth to haue defect in ſuch ſorte, that hee cannot ſerue. Therefore in this Chapter, I will ſpeake of the defectes that a Compaſſe may haue, and howe the Pylot hauing neceſſitie, may amend it. For the which is to bee noted, that for one of theſe fiue cauſes, the Compaſſe cannot iudge the North.

The firſt is, by the ſtiles not being well touched with the Lodeſtone, that he lacketh the vertue. And this ceaſing which is the cauſe, the effect ceaſeth, which is to ſhew the North.

The ſecond, becauſe the capitall is wreſted, and not vpright, that he doth not ſuffer the roſe to goe right in his ſteppe.

The third, becauſe the ſteppe is broad, ſo that the roſe cannot moue with quickeneſſe.

The fourth, becauſe the roſe lieth downe, and hangeth more to one ſide then to another.

The fifth, becauſe the cheſt of the roſe is open, in ſuch ſorte that the ayre entreth into it.

The firſt, if the ſphere or hinges, whereby the ſayd boxe or cheſt is ſuſtained, are not ſo light that the cheſt and the roſe may goe equall.

To the firſt, the Pylot ought to carry in his cheſt a Lodeſtone, and that he haue experience that it be good, and with the face thereof to rub or touch the pointes of the compaſſe ſubtlely vntill there cleaue to it, a little of the ſayd ſtone, and ſee that it be with the face of the ſayde ſtone, the which hee ought to haue marked, to which parte it is, for if it be with another parte it maketh not the true effect.

To the ſecond, which is the capitall to be layd downe, for to know when it is ſo, take a Compaſſe and put the one point in the heade of the capitall, and the other in one of the circles of the roſe, and thereby you ſhall knowe to which parte he is wreſted, and howe much it is needefull to dreſſe him, and it is to be vnderſtoode, that if the capitall bee not verie vpright, the roſe will put him cleane out of his place, although hee bee verie well touched.

To the thirde, if the ſteppe be broad or flat, he ought to be finely filed, ſo that it beene ſeene, that the roſe runne not haſty nor to ſlowly, and if by fyling of him, it be ſeene that the roſe doth runne ouer much, touch him ſubtilly with ſome yron in the poont, that he may bee ſomewhat broade, ſo that the roſe may runne ordinately.

To the fourth, if the roſe goe ſomewhat laid downe, and doe not goe very equall, you may put to him ſome ware, or pitch, or a thing that may cleaue faſt to him in the vnder parte, vntill that he goe vpright, without leaning to one part more then to the other.

To the fifth, he ought to looke that the boxe or cheſt where the roſe goeth be ſo neere, that there goe not in any ayre as well by the parte of the glaſſe, as by the parte which is ſhut, and if it be open in any part, with the ſayd ware or pitch, it ought to be ſhut.

To the firſt, I ſay that he ought to looke in the Sphera or hinges, wherein the ſayd cheſt or boxe goeth put, vpon the which it is ſuſtained or helde vp

that it be so good and light that the sayd bore or chest goeth alwayes equal, in such sorte, that although the shippe doe hilde or doe lie downe to one side or to the other, the sayde bore and rose be alwayes right, for if the pyons, wherein they mooue, be hurte the cause that when the shippe doth hilde to one side or other, the bore and the rose cannot iudge the Mayth in his proper place.

So that it is conuenient that the sayde Compasse or needle bee precisely made without hauing defect or lacke, or if there bee any inconuenience, although it be very little, it causeth much errour,

The seconde Chapter, how the windes of the Compasse ought to bee vnderstood, and how the sunne passeth euery day by them.

IT is necessary, that the Pylot vnderstande two thinges in his Compasse, the one is, how the East and West, which are marked in the Compasse ought to be vnderstood.

The second, how that in euery foure and twenty houres, the Sunne doth passe all the courses of the Compasse.

To the first is to be noted, that this name East and West is taken two wayes, (that is to say) naturall and respectiue: the East and West is naturall, and is vnderstoode by the Equinoctiall line, and not by any other part, because it is the middest betweene two extreame partes, (that is to say) the two Poles, as his definition declareth.

The respectiue is by another manner of parte where a man is, nowe neare the line, nowe farre off, so that if a man be fiue degrees from the line, or tenne, or more or lesse, all that he is in the same degrees, he shall be towardes the East and respectiue towardes the West, in such sorte, that all that he is from the place, where the Sunne riseth to the Meridian where the man is, he shall be towardes the East, and that which hee is from the man vnto the place where the Sunne setteth, hee shall bee towardes the West, and this likewise is to be vnderstoode being in the Equinoctiall, as also forth of the Equinoctiall.

An Example.

Of this may be asked, if the citie Seuill be towardes the East or West, that is, towardes Leuante or Poniente, it is answered, that it is not in the East and West naturall, and as much as toucheth the respectiue, it is towardes the East, and it is towardes the West, I will say, that likewise it is towardes the Leuante and it is towardes the Poniente, in this maner. Of that which it is most occendentall is towardes Leuante, and of that which

is most orientall, is towardes the Poniente, so that if Seuill bee in thirtie seuen degrees of the Equinoctiall, towardes the parte of the Nozth, all that it is in the right course of the ~~the~~ thirtie seuen degrees it is with Seuil East and West, in such sozte that all that it is from the Meridian of Seuill vnto the parte of Poniente, Seuill hath towardes the Leuante, and that which is from Seuill towards the part of the Leuante, Seuill hath it towards Poniente. We haue an authour of this, who as Saint Luke in the first Chapter, where hee saith, that the three kinges came from the orientall partes to Hierusalem, it is to be vnderstoode, that as Hierusalem was moze occidentall, then from whence they came, so they came from the orient, to occident, which is from the East to the west.

Therefoze I say to our purpose it is not to be vnderstood that the course which is marked in the Compasse, is the East and West, respective, oz accidentall, but the naturall which is by that straight course, which the Sunne doth describe in that mooning which he maketh the eleuenth day of March, and thirteenth of September, foz that is East and West, that is marked in the Compasse, (that is to say) by the Equinoctiall, so that from the East to the Nozth are nientie degrees, and seuen courses, besides the East and the Nozth, and the like vnto the South, And if the East of the Compasse were respective the nientie degrees, noz the seuen windes oz courses, should not be reckoned the which would be a very great errour.

To the second, I say that howe much a man is farthest of the Equinoctiall, so much the dayes will be greater to him when the Sunne goeth of this parte where he is, and by reason that the dayes are greater to him, the rising of the Sunne may be different to him, in this manner, those which inhabite vnder the Equinoctiall, oz in any other parte, when the Sunne doth describe the sayd line, alwayes he commeth fozth to them in the East, and setteth to them in the West, and they haue twelue houres of day, and twelue of night, so that in the foure and twentie houres wherein the Sunne maketh his daily mooning hee passeth all the eight windes oz principall courses of the Nauigation, In such sozte, that from three to three houres, hee goeth from one winde to another, and so hee riseth and commeth foozth to vs at fire of the clocke, at the East, and at nine at the Southeast, and at twelue at the South, and at three at the Southwest, and at fire at the west, and there he setteth. So that in twelue houres he goeth foure courses, but out of the Equinoctiall, howe much the day is greater so many moze courses the Sunne goeth in the day, and lesse in the night, so that if the day be of fifteene houres, the Sun goeth in the day fiue courses and by the night three: and if the day be of eighteene hours the Sunne goeth in the day fire courses and by night two: and if the day be of one and twentie houres, the Sunne goeth in the day seuen courses,

and by night one: and if the day bee of foure and twentie houres the Sunne goeth twenty foure houres in the day, which are eight courſes, and that day there is no night: as it happeneth to thoſe which inhabite in the circles, when the Sunne commeth to the Tropikes. And that which is vnderſtood of the dayes when they goe increaſing, and the nightes diminiſhing, the ſame is to be vnderſtoode by the courſes which the Sunne goeth by night when the day goeth diminiſhing, and the night encreaſing: as ſhall be declared in the firſt Chapter of the eight booke, ſo that the quantitie of houres being knowne which the day hath, the Pylot may knowe to what courſe of the Compaſſe the Sunn riſeth from him and ſetteth euery day, this reaſoning will ſerue for many thinges of the Nauigation.

The third Chapter, wherein is declared, the opinion that is had in the Northeaſting, and Northweſting of the Compaſſes.

There is an opinion among ſuch as ſayle that the Compaſſes doe Northeaſt-ſleare, and Northweſtear, and it is ſayd that in the Meridian of the Ilandes of the Achores, that there the Compaſſe doe ſhew the Pole in his place. And from thence paſſing towardes the Weſt, it doth Northweſtear, this is that he ſheweth not the Pole in the place where hee was firſt, but that he goeth aſide towardes the Northweſt. And if they come from the ſayd Meridian, towards the Eaſt, that the Compaſſe doth Northeaſtear, that is, to make the ſayde difference towardes the parte of the Northeaſt, ſo that they ſay, that onely in that Meridian the Compaſſe doth ſhew the Pole, and not in any other place: but to one parte or other: and how much more they departe from him, ſo much the Compaſſes haue more the ſayde defect, but thoſe which vnderſtand this, giue no cauſe nor any reaſon, nor how much this difference is, which the Compaſſe maketh, and how farre it goeth, ſo that they know not what to ſay more, but marking their Compaſſes, it ſeemeth that which is ſayd to be ſo.

Herevpon I haue procured to ſeeke ſome Authour or reaſon, or ſome thing wherein this ſhould haue a foundation, and I ſay that this variation which is ſpoken of the Compaſſe, I find not any thing written, nor reaſon, nor experience, that is certayne: therefore here I will ſpeake my opinion, touching this, perſwading my ſelfe to that which is moſt naturall and true of the Nauigation.

Therefore comming to the cauſe, I ſay putting an example, if I make two Compaſſes of one ſelfe ſtile, and of one temperance, and touched with the one ſelfe ſtone, and two ſhippes going ſayling with them, departing from the ſayd Meridian one towardes the Eaſt, and the other towardes the weſt, that theſe Compaſſes ſhall make, different effectes in ſuch ſorte, that in the

one

one, the stone and the stile, should haue vertue to cause Northeasting, and in the other, to cause Northwesting which are contrary effectes, it seemeth not to me, that there is any foundation, or reason to haue the like. But let vs see if this bee in any thing of the Nauigation, let vs seeke it in three parts, which is the Pole of the Compasse, or in the way where sayling nowe is vsed.

To the first, to say that the Pole doth make any variation or distance from his place or poynt, this ought not to be thought, because it should bee put out of order all the order of the Sphera, in such sorte that all the fixed circles, should bee moueable: besides this, if the Pole shoulde moue with him that sayleth towardes the East, it would moue it selfe in the same time with him which sayleth towarde the West. This is vnpossible howe much more that the Pole cannot moue to one parte or to another because it is a point imagined alwayes fixed in one place.

To the seconde, I say that it ought not to be thought or vnderstood, that the Compasse by himselfe maketh the sayde difference, for it is certayne, that the sayd natural vertue or property which the stone and steele haue in the place where the Compasse was made, the selfesame they haue in the sayd Meridian, and in the new Spaine, and the Calicut, and in all parts. And there is no reason to say, that this propertie is of much quallitie, that in the sayde Meridian it hath one vertue, and in all others, which are well neere infinite, it hath it in euery one, different, for if it were so, it would be to giue a great inconuenience, the which is ý in no part foo, th of the said Meridian, there could bee made a true Compasse, seeing that in no parte the Compasse doth shewe the Pole but there, and to say so it were a verye great errour, because an instrument so important to the Nauigation, should not be sayde, that in no parte it coulde be made certayne, for if it were so, it were to giue the Nauigation an instrument with a knowne errour.

To the third, that is by the way where you sayle, this is knowne, that in any manner of place where a man is, there he hath his Meridian, the which goeth precisely to remayne at the poynt, which is the Pole, without making any distant or difference in any thing.

And if it should be sayde, that by reason of the way which the shippe sayleth, the Compasse maketh the sayd difference as well towardes the one parte, as to the other, this would be to make many Meridians different, the one from the other, and so they shoulde goe to remayne at different Poles, in such sorte that howe many differences the Compasse went making, by reason of the way: so many different Meridians, the way shoulde haue: and to euery Meridian of necessity, there should a Pole bee giuen, where he should make an ende, for otherwise it would be an infinite processe.

ſo that there ſhould be giuen an infinite number of Poles. And to thinke this ſhould be a very great errour, ſo that it appeareth well, that neither by the parte of the Pole, neither of the Compaſſe, nor of the way where you ſayle, the ſayd Compaſſe doe make any variation or difference from his proper place, but making more inquirie of this variation, which of the Compaſſe is ſpoken: I ſay that commonly is vnderſtood that the compaſſe doth ſhew the Pole, but of this there is no writting which doth ſay ſo: that which I finde written of the Lodeſtone, and of yron is, that Plinie in his thirtie fixe booke of the naturall hiſtory ſayth, and alſo Saint Iſidore in the ſixteenth of the Etimologias, that the Lodeſtone by one hidden vertue or propertie, that it hath doth ſpecifie that it draweth to it yron of this Auicen ſpeaketh in the booke of Viribus Cordis, the tenth Chapter, hee aſketh what the cauſe is, wherefore the Lodeſtone doth draw vnto it yron, to the which he anſwereth, that there is no other thing can be ſayde, but becauſe it hath a naturall vertue to draw it to him, and he ſaith that ſome vnderſtoode that hee draweth it to him by reaſon of heate or coldneſſe, or becauſe of ſimilitude, that both of them haue in nature, or for other reaſons, all the which he ſaith is falſe, for that he draweth it not, but onely with his propertie, and declaring what thing propertie is, he ſayth, propertie is found in nature in the compounded bodies, proceeding in them, a moſt high and full influence, ſo that we ſee that the Lodeſtone doth draw to him the yron: likewiſe wee ſee that the yron being robbed with the ſayde ſtone, I ſay in one onely parte of it the vertue remaineth with the yron to ſhewe alwayes one poynte, Which is anſwerable to the place where we doe ſhewe in the Horizon the winde at North: ſo that ſeeing the Pole is imagined in the heauen, and is not ſeene, and the Compaſſe doth ſhew him in the Horizon without any riſing, one onely degree aboue the Horizon: it is cleare that neither the Compaſſe doth ſhewe the Pole, nor by the ſayde Compaſſe the Pole can be ſeene when it is equall with him, nor when it is at one parte nor at another, euen as I ſhould not know, when I am right with that which I ſee not, nor when to one part nor to another. This being vnderſtoode, I minde to declare here whereupon they ground them ſelues, which are of opinion that the Compaſſe hath a Northeaſting and a Northweſting, and the manner whereby they ſay, that they knowe it, which is this. The Pylots which doe marke their Compaſſes doe beholde the North ſtarre to marke them by her, but becauſe this ſtarre doth alwayes mooue, as before it hath beene declared, therefore they tarrie vntill the guardes bee in the Northeaſt, or in the Southeaſt, for then they thinke, that the ſayde ſtarre is in the oppoſite of the Pole, vnder or aboue him, and then they imagine a ſtreeke which deſcendeth from the ſayde ſtarre vnto the Horizon, and they imagine another

ſtrecke

streeke which goeth from the poynte of the floure of the Compasse, vnto that poynt of the Horizon, so that in these 2. streekes, which they put in that point, they looke if that poynte bee straight vnder the North starre, and so they speake what their opinion is without hauing in this anye other account or reason.

To this is to be noted two things. The first that the guardes being in any of these sayd courses are not in oppolite of the North starre, and the Pole rather is a poynte different, for because to stande in oppolite, the guardes ought to be in the Northeast, and by North, or in the Southwest and by South.

The seconde, that this making iust of the Compasse is alwayes done by night, because by day there is no starre seene. And from the starre vnthe Horizon, the distance is verye great, by which the true poynte that is correspondent, to the sayd starre, cannot be knowne in the Horizon. But that at one time is iudged one, and at another time another, Likewise for the great distance, that is from the sayd Compasse, vnto the poynt which is imagined in the Horizon: And as that poynt is imagined, and inuisible, alwayes the sight goeth wauering without establishing it selfe, which hath happened sometimes to mee, making experience in this. And therefore I say, that according to the perspectiue rule, the precise poynt of the Horizon cannot bee taken with the onely sight which is imagined vnder the sayde starre, nor it can make iustly equall, the poynt of the flower of the Compasse, by reason there is no certayne poynt, and the distance very great, which is to that as is imagined. For the sight fayleth when the obiect is very distant. Whereby I conclude, that it cannot bee precisely knowne in the Compasse, by the manner as it is sayd, if he make the sayd distance of the Pole, nor howe much it is, nor I by this way coulde euer attayne to it.

The fourth Chapter, of the inconueniences, which may follow by the Northeasting, and Northwesting of the Compasses.

AMong other inconueniences, that will follow in the Nauigation, if the Compasses should make the sayd variation or difference, I finde foure very principals, which are these following.

The first if it bee true, that the Compasses haue a Northeasting, and a Northwesting, likewise it may be sayde, that they haue a Southeasting and Southwesting, and the reason is this, it is certayne that the variation or difference which the Compasse doth make to the part of the North, the same ought to be made, towardes the parte of the South, I will say that how much the North poynte of the Compasse departeth from his owne poynt,

poynt, so much the South poynt of the sayde Compasse goeth distant to the other parte, and so the Noyth poynte of the Compasse doth Noytheast a quarter oy moze, and the South poynt doth Southwest the like, foy the Noyth poynt cannot goe aside, but the South poynte doth the like. And so when you shall sayle towardes the parte of the South, seeing that there the Noyth starre is not seene to marke by her, either it must be sayd, that of that parte the Compasse doth not make variation, oy if it doe, that in the South, it is to bee knowne: and when so you shall sayle to the Riuer of Plate, otherwise called Rio de Plata, oy the straight of Magalanes, oy by the South Sea, oy to the cape of Buena Esperanca which is in englishe, good hope, and from thence to Calicut oy the Maluco, then will be laid, that the South poynt of the Compasse doth Southeast oy Southwest, and to say so should be a greater errour.

The seconde if the Noyth poynte of the sayde Compasse doe make the sayd distance of his proper place, and poynt, it is certayne that the selfe same difference and distance all the other winds of the Nauigation should make from their proper places, because how much any winde doth depart from his proper place, the selfe same all the others should doe by the agreable order, and equall distance, that they haue in the Compasse, the one with the other, and so none would answere to the certayne poynte, that is shewed in the Horizon, so that likewise, there would mooue from their place, the East, and the West, and all the other windes, this would be a very great inconuenience, foy the Compasses would neuer agree with the Cardes, this is because alwayes the windes of the Cardes are fixed in one poynt, without mooning from thence, therefoye if the winds of the Compasse doe make many differences, it is certayne, that they cannot be agreable: and not agreeing; The place which you goe to seeke cannot in anye manner of wise, be precisely hit, but with great Compasse, this will cause it by reason the Carde sayth one thing and the Compasse another, and so there cannot be had a certayne account, in the degrees and leagues which are sayled, rather all the accountes oy reckoning of the leagues which is geuen foy a degree in euery course, should be false seeing the Pylot doth not sayle by the course, which hee thinketh hee doth, and so the reckoning which is made, by such a course, should not bee certayne, and if he would giue allowance it would bee nothing wooyth, foy hee knoweth not of what parte noy howe much, and so it would bee to adde one errrour to another.

The thirde, if the variation oy difference which is spoken of in the Compasse, were certayne it would follow, that the Compasses which were distant of the sayd Meridian at the East oy at the West, they should haue great difference, if it be true, that howe much moze they are distant, so much

much more they haue the sayde defect, and so all the earth, that should be discouered, with these Compasses, and should be set downe in the Carde, should not be in his true poynt, the reason is, because the principall winds of the carde (that is to say) the North and the South, the East and the west, are marked in foure fixed poyntes equally distant, which are the two poles and the Equinoctiall line: and according to these all the other windes of the Carde are marked and parted, for if there were put into the Cardes any other thing it would be to make an errour at the beginning, which is not conuenient in a thing so certayne, as the Nauigation is, so that all these windes are alwayes stedfast and fixed, in their owne poyntes, without making variation or any difference, so that all which is placed with the compasse by reason of his difference, wil not be answerable with the certain point, according to the windes which are in the Carde.

The fourth if the variation of the Compasse be true, immediatly would follow great difference betweene the course and the altitude, because that I, by the way or course doe seeke a lande, which I knowe is in thirty degrees, or more or lesse, and I sayle by one poynt the which I haue chosen agreable to the altitude. It is certayne that by reason of the variation of the sayd compasse, I shall not goe by this course to the land which I goe to seeke, but rather when I haue gone, the said way, I shall find my selfe forth of that place, whether I goe very different, of the which, the errour of the Compasse was cause thereof.

And so in long wayes will alwayes happen great hurts and inconueniences. Therfore I say, seeing that the said opinion hath no more reason nor foundation, then that which is before said, that such as doe follow it, let them look to the hurts and daungers which may follow them.

The fifth Chapter of the allowance, which the Compasses haue, and how it ought not to be giuen them.

SOme which make Compasses haue a custome, that at such time as they doe set the stiles in the rose of the windes, they doe not precisely put the flower of the rose vpon the poynts of the stiles, which are touched with the Lodestone, but they put them aside of the flower halfe a poynte from the Northeast, and this they say they doe to giue allowance to that which the Compasses doe Northeast, so that the Compasse doth remayne, made in such manner that the stiles, and the flower are not vniforme in shewing the North poynte, because the flower doth shewe him to one parte, and the stiles doe shewe him to another: this is a knowne errour, and it ought to bee done in no manner of wise, for the reasons following.

The

The first, if it be true that the Compasses doe Northeast and Northwest: it is also sayde that they doe as well Northeast as Northwest, so that the difference which is giuen to the one part, the selfesame is giuen to the other, and if it bee so, by what reason shoulde bee giuen to it the allowance, alwayes to the one parte, and not to the other, therefore it is certayne, that if to the Nauigation that is made towardes the West, the allowance doth profite that which is made towardes the East, it would hurte, seeing they are different the one with the other, so that what it doth benefite the one, it will hurte the other. Likewise, with the selfe same Compasses, which they goe on any voyage, with the selfe same they returne, without taking away, or putting to any thing in them, thereby it is cleare, that the said errour is to be perceiued, seeing that the allowãce cannot serue to both partes.

The second, if it be true that in the Meridian of the Acores the Compasse doth not make any difference from the pole, I say that this cannot be known, by the sayd Compasses. (The reason is) because the vertue of the Compasse is in the stiles, and not in the flower, and the pylot looketh not vnto the stiles, but vnto the flower, because he cannot see the stiles, and the flower sheweth one, and the stiles another, whereby as he ruleth himselfe by the flower hee cannot know the truth.

Likewise what reason is there, that there is giuen there to the Compasse, as much allowance, as in other partes which are farre of. Of this doth follow, that for the allowance or difference put in the said Compasse cannot be knowne, when the Pylot is in the sayde Meridian. Therefore it is so as it hath beene sayde, when the stiles doth shewe, the flower doth not shewe. And so the sayde Meridian cannot bee knowne, if it bee not in seeing the sayde Ilandes, by reason of the difference that is betweene the stiles and the flower.

The thirde I say, that there is no reason, wherefore so much allowance should be giuen to the compasse in the sailing of a hundreth leagues, as in the sayling of two thousand, by the which reasons, it is not conuenient, that to any Compasse the said allowance or difference be giuen betweene the flower and the stiles, but that they be made euen very precisely, so that they may be vniforme in their shewing.

The sixt Chapter, of an instrument, with the which the Compasses may be marked, and knowe if they be certayne and true.

IT hath beene sayde, that by the poynt of the Horizon, which is correspondent to the North star the compasses cannot be marked, because it is an vncertayne poynt, so that because the Compasse is an instrument so little and so

ſo ſubtile, it is neceſſary to bring him in order with another inſtrument, ſuch a one as the ſight and the reaſon may rectifie.

Therefore when the Pylot will marke his Compaſſe, and know if he be true or not, let him make the inſtrument following: with the which I haue many times marked Compaſſes, and haue found it certayn, ſet downe your Compaſſe vpright, and put vpon him a little thinne table and playne, a little longer then the Compaſſe, and narrower then the roſe, ſo that the North and the South be ſeene of the roſe: And in this table make a circle with the Compaſſe, well neere of the greatnes of the roſe, and make in the ſayd circle a ſtreeke very equall and ſtraight, that may goe from the North to the South of the roſe, ſo that the roſe ſtanding ſtill, the ſtreeke of the circle of the table, be ſuch that he come preciſely with the North and South of the roſe, this being done, put in the poynte with the Compaſſe made in the middeſt of the circle of the table, a little ſmall maſte vpright, and that he be ſo great that the ſhadow which he maketh, goe forth of the circle, and being put ſo, then ſet your compaſſe in the Sunne before the middeſt of the day, and there make equall the ſtreeke of the circle with the roſe, as before is declared, and the Compaſſe ſtanding quiet and the table fixed aboue, doe you ſtay vntill the ſhadowe which the little maſte doth make, doe come ſhortning vntill he come to the ſayd circle, and when he is come, make a poynt there. And after that ſtay vntil the ſayd ſhadow doe turne to goe forth of the circle, and when hee commeth to it, make there another poynt, this being done, take your Compaſſe, and part iuſtly that which is from one poynt to the other.

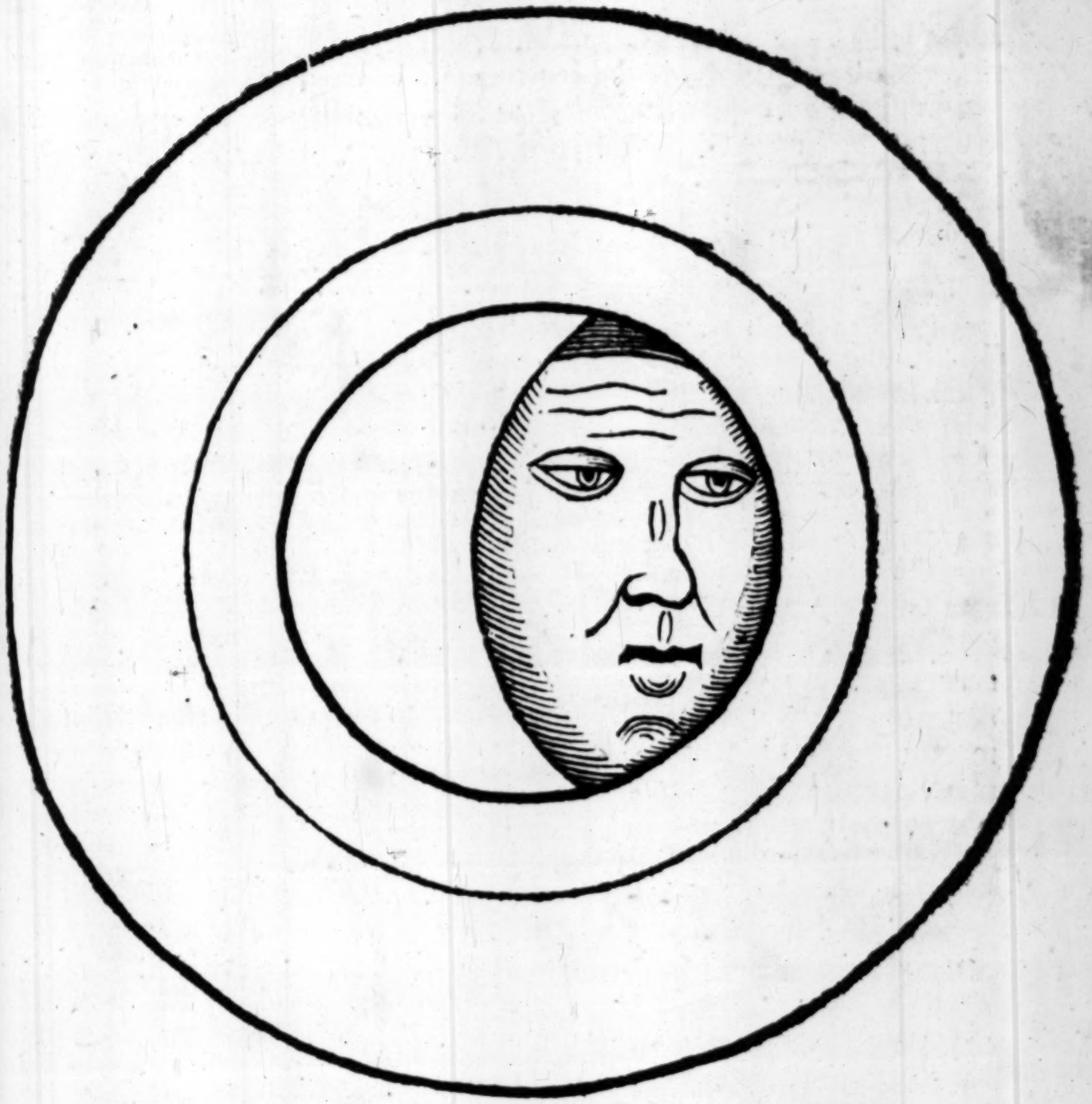
And to this poynt of the partition, the Meridian of that place is correſpondent, it is to be ſeene if the ſtreeke which was made in the circle of the North and South, of the Compaſſe doe come by the the ſayd point of the partition, then the Compaſſe is good, and if not, there it is to be ſeene, to which part he maketh difference, and how much it is.

The ende of the ſixt booke.

The seuenth booke of the Moone, and how her ebbinges and flonings doe serue in the Nauigation.

The first Chapter, what thing the Moone is, and wherefore her light is not equall, but alwayes increaseth or diminisheth.

THE Moone is one of the seuen Planettes, constituted in the first Heauen more neere vnto vs then any of the others, of this some had opinion, that shee had light of her selfe, and when she was in one signe with the Sunne, by meanes of the great light of the Sunne, she gaue no light, and how much the more she went from the Sunne, so much her light began to appeare. This is not so, because the Moone hath no clearnesse nor brightnesse of her owne, as in the first booke the seuenth Chapter, hath beene declared, the which is seene by experience, because the Moone doth suffer Eclipses, when she is depriued of the light of the Sunne, as there is a let, that shee cannot receiue it, she remayneth darke. This light is let by meanes of the earth, as the Philosophers and Astronomers doe shew, because in the mouing which ỳ sun and the moone make, as they come into the point, that the earth is directly betweene the Sun and the Moone, the light of the Sun giueth in the earth, and so the Moone remayneth in her owne likenesse, which is darke, so that of her owne selfe, shee hath no light nor clearenesse, but the Sunne which is ouer her, doth light her, although not euerye daye alike towards vs, because as the Moone is a body darke, when shee is right vnder the Sunne, she is lightened of the vppermost part, and remayneth darke towardes the earth, and therefore in her coniunction with the Sunne, we see her not. And it is to bee noted, that in the coniunction of the Moone, shee and the Sunne rise not in one selfe place, but they rise at one selfe time, and so by meanes of the light of the Sunne, the Moone doth not appeare, because cõming for that one selfe time in one place the sun would be eclipsed, and so the eclipse of the Sun happeneth in the coniunction of the Moone, when she is in the heade or tayle of the Dragon. And as by her mooning, sh goeth away from the Sunne shee beginneth to appeare vnto vs, and appeareth in the manner of a thinne horne, and the farther she goeth from the Sunne, the more she shineth to vs. And at the eight day she shineth parted in the middest, and at the fifteene day shee is full, for then she is farthest of the Sunne, the which is prooued because it happeneth, when the Sunne doth



doth ſet to vs in the Weſt, and then all the brightneſſe, which the Moone receiueth of the Sunne deſcendeth towardes vs, and after ſhee beginneth to goe neerer to the Sunne, by the ſame manner that ſhee went departing, and when the light goeth vpwarde the ſhadowe deſcendeth, and ſo ſhee turneth decreaſing, in the like ſorte as ſhee went increaſing. And it is to bee noted, that the Moone doth paſſe the circle of the Zodiacke, in twentie ſeuendayes and eight houres, and although that in this time, ſhe maketh an ende of this circle, there is giuen to euery Moone twenty nine dayes, and

halfe

halfe. The reason is, because in those sayde twentie seuen dayes and eight houres, she doth not ouertake the Sunne, and therefore passeth forwarde other two dayes, and foure houres, a little thing more or lesse, and so twentie 9. dayes being past, and twelue houres, and a few minutes, in some more, and in others lesse, the coniunction of the Moone and the Sunne is made. This is according to the halfe mouing of the Moone, wherewith is made equall, the mooving of all the dayes, because according to the true mouing which she maketh, at sometime it is said to be slow, and at other times swift, the which mooving is also made equall by the middle mouing, this is largely declared by the king Don Alonso in his tables.

The seconde Chapter, of the Golden number, and how it is to be reckoned from one to nineteene, and wherefore no more nor lesse.

IT is a nessary thing to take out the reckoning of the Moone by the Golden number, for that the Golden number is a thing whereby many reckoninges are made, and therefore it is called the number of Golde, whereof I minde to declare in this Chapter, that of the Golden number which maketh to our purpose, where I say that this reckoning of the Golden number is, from one to nineteene, so that the Golden number is accomplished in the time of nienteene yeeres, and the nienteene yeeres being past, returneth agayne to one and so for euer. The reason why it hath this number, and no more nor lesse is because the nienteene yeres being past, the Moone turneth to one onely day, of the yeere, of the Sunne, and in this time she finisheth and endeth all those diuersities of coniunctions and fulnesse, and other aspectes which she hath with the Sunne in one onely day, degree, and minute, in this manner following.

I put the case that the Moone made coniunction the first day of January of this yeere. The yeere following shee will not make the same coniunction in the same poynte, but before or after, and so wee will speake the like of the fulnesse, and other aspectes. And as these be not in an infinite number, it is certayne that they are comprehended in some number, or space of time.

These are those sayd nienteene yeeres, in the which are to be noted, as it is sayd, all the diuersities of aspectes, aswell of coniunctions, and fulnesse, as of any other cause, which the Moone maketh with the Sunne, in such sort, that the nienteene yeeres being ended. The Moone doth not turne to make a new coniunction or oppositon in any degree or point of the Zodiacke, that in the sayd time, she hath not already done, and by this reason this reckoning of the golden number is ended and finished in the time of nienteene yeeres, and not in more nor lesse.

A rule to know the golden number of euery yeere.

TO knowe euery yeere how many are of the Golden number, looke on the numbers following and counting in the firſt houſe, the yere of our Lord 1545. which are ſeuen of the Golden number, and one houſe is to be reckoned euery yeere, and the laſt houſe being ended, returne to the firſt and ſo for euer.

1545.	7.	8.	9.	10.	11.	12.	13.	14.	15.					
16.	17.	18.	19.	1.	2.	3.	4.	5.	6.					

WHen you will knowe in any yeere that you are in, howe many are of the Golden number, without looking on the booke, ſee in what yeere you runne, and leauing out the thouſand fiue hundreth, of the reſt take out the nienteenes, and that which remayneth, ſo much is of the Golden number that yeere, and if the number of the yeeres come iuſt in nienteenes, that yeere is nienteene of the Golden number.

The third Chapter, wherein is declared the day and houre, wherein the Moone maketh coniunction in euery Moneth of the yere for euer.

THere hath beene declared in the Chapter before, howe it ſhoulde bee knowne, euery yeere howe many are of the Golden number, according as the account in it is declared, and becauſe it is neceſſarie for the Nauigation to know in euery moneth the day and houre of the coniunction, therfore in this Chapter, ſhall be declared, how a man may know euery day what day and houre the coniunction of the Moone was, or ſhall be. And for this are to be noted, two things, the firſt, that this account goeth taken out by the golden number, and by him you muſt rule your ſelfe, euen according as the number is, which that yeere, wherein you are, doe runne of the Golden number: In that ſayd yere, looke the Moneth where you are, or the Moneth that you would know, and in him you ſhall finde the day, and houre that the Moone was or ſhall bee in coniunction. The ſecond is, that in this account a day is vnderſtood from this day the middeſt of the day, vntill to morrow, the middeſt of the day, ſo that if we ſay, this day is the fifteene day of the Moneth it is vnderſtood, from this day the middeſt of the day, vntill to morrow the middeſt of the day, and from the middeſt of the day to morrow, doth 16. begin, becauſe this is the maner, that the Aſtronomers doe reckon the daies, ſo that thoſe hours which are ouer and aboue, the dayes are from the halfe day forward.

If they be one of the Golden number.

Months	Daies	Hours.
Iaunarie.	19	16
Februarie.	18	6
March.	19	7
Aprill.	18	1
May.	17	9
Iune.	15	15
Iuly.	14	23
Auguſt.	13	8
September.	11	21
October.	11	12
Nouember.	10	6
December.	10	1

If they be two of the Golden number.

Months	Daies	Hours.
Ianuarie.	8	20
Februarie.	7	13
March.	8	4
Aprill	6	16
May.	6	2
Iune.	4	9
Iuly.	3	15
Auguſt.	1	7
September.	29	19
October.	29	9
Nouember.	28	1
December	27	20

If they be three of the Golden number.

Months	Daies	Hours.
Ianuarie.	27	14
Februarie.	25	9
March.	27	1
Aprill.	25	4
May.	25	0
Iune.	23	8
Iuly.	22	16
Auguſt.	21	0
September.	19	8
October.	18	19
Nouember.	17	7
December.	16	22

If they be foure of the Golden number.

Months	Dayes	Hours.
Ianuarie.	15	0
Februarie.	14	19
March.	16	3
Aprill.	14	19
May.	14	9
Iune.	12	11
Iuly.	12	7
Auguſt.	10	16
September.	9	1
October.	8	10
Nouember.	6	20
December.	6	7

If they be fiue of the Golden number.

Months	Dayes	Hours.
Ianuarie.	4	20
Februarie.	3	11
March.	5	3
Aprill.	3	20

May.	3	13
Iune.	2	2
Iuly.	1	4
Auguſt.	29	16
September.	28	2
October.	25	12
Nouember.	25	22
December.	25	8

If they bee ſixe of the Golden number.

Months	Daies	Hours.
Ianuarie.	23	20
Februarie.	22	9
March.	22	22
Aprill.	21	8
May.	21	4
Iune.	19	19
Iuly.	19	9
Auguſt.	18	0
September.	16	13
October.	16	2
Nouember.	14	14
December.	14	1

If they be ſeuen of the Golden number.

Months	Daies	Hours.
Ianuarie	12	11
Februarie.	10	21
March.	12	8
Aprill.	10	19
May.	10	7
Iune.	8	20
Iuly.	8	10
Auguſt.	7	2
September.	5	17
October.	5	10
Nouember.	4	1
December	3	15

If they be eight of the golden number.

Months	Dayes	Hours.
Ianuarie.	2	3
Februarie.	31	22
March.	31	22
Aprill.	29	17
May.	29	3
Iune.	27	14
Iuly.	27	3
Auguſt.	25	29
September.	24	12
October.	23	6
Nouember	22	23
December.	22	19

If they bee nine of the Golden number.

Months	Daies	Hours.
Ianuarie.	21	4
Februarie.	19	15
March.	21	0
Aprill.	19	8
May.	18	16
Iune.	17	0
Iuly.	16	9
Auguſt.	14	21
September.	13	12
October.	13	
Nouember.	12	1
December.	11	19

If they be tenne of the Golden number.

Months	Daies	Hours.
Ianuarie.	10	12
Februarie.	9	3
March.	9	16
Aprill.	8	1
May.	7	9
Iune.	5	16
Iuly.	4	23
Auguſt.	3	7
September.	1	18
October.	31	8
Nouember.	29	19
December.	29	14

If they be eleuen of the Golden number.

Months	Daies	Hours.
Ianuarie.	28	8
Februarie.	27	1
March.	28	15
Aprill	27	1
May.	26	9
Iune.	24	16
Iuly.	23	23
Auguſt.	22	7
September.	20	7
October.	20	5
Nouember.	18	21
December	18	14

If they be twelue of the Golden number.

Months	Daies	Hours.
Ianuarie.	17	9
Februarie.	18	15
March.	17	21
Aprill.	16	11
May.	15	23
Iune.	14	8
Iuly.	13	16
Auguſt.	12	0
September.	10	8
October.	9	17
Nouember.	8	5
December.	7	18

If they be thirteene of the Golden number.

Months	Dayes	Hours.
Ianuarie.	6	10
Februarie.	5	3
March.	6	21
Aprill.	5	15
May.	5	6
Iune.	3	19
Iuly.	3	6
Auguſt.	1	15
September.	29	10
October.	28	19
Nouember.	27	6
December.	26	18

If they be fourteene of the Golden number.

Months	Dayes	Hours.
Ianuarie.	25	7
Februarie.	23	23
March.	24	15
Aprill.	23	7

May.	22	22
Iune.	21	13
Iuly.	21	1
Auguſt.	19	13
September.	18	1
October.	17	11
Nouember.	15	22
December	15	8

If they bee fiftneee of the Golden number.

Months	Daies	Hours.
Ianuarie.	13	18
Februarie.	12	6
March.	13	19
Aprill.	12	9
May.	12	0
Iune.	10	20
Iuly.	10	5
Auguſt.	8	20
September.	7	10
October.	7	0
Nouember.	5	13
December.	5	0

If they be ſixteene of the Golden number.

Months	Daies	Hours.
Ianuarie	3	10
Februarie.	2	20
March.	3	6
Aprill.	1	17
May.	1	4
Iune.	29	15
Iuly.	28	21
Auguſt.	27	13
September.	26	6
October.	25	22
Nouember.	23	13
December	24	1

If they bee ſeuenteene of the golden number.

Months	Dayes	Hours.
Ianuarie.	22	12
Februarie.	20	22
March.	22	7
Aprill.	20	16
May.	20	1
Iune.	18	11
Iuly.	17	23
Auguſt.	16	14
September.	15	7
October.	15	1
Nouember.	13	19
December.	13	11

If they be eighteene of the Golden number.

Months	Daies	Hours.
Ianuarie.	12	2
Februarie.	10	14
March.	11	0
Aprill.	0	7
May.	8	8
Iune.	6	23
Iuly.	6	8
Auguſt.	5	19
September.	3	8
October.	3	1
Nouember.	1	19
December.	1	14

If they be nienteene of the Golden number.		
Months	Dayes	Hours.
Ianuarie.	30	5
Februarie.	28	14
March.	30	1
Aprill.	28	9
May.	27	15
Iune.	25	13
Iuly.	25	6
Auguſt.	23	16
September.	22	4
October.	21	23
Nouember.	20	14
December.	20	19

It is to bee noted, that for the coniunctions of the Moone before written, ſhal be taken out, the oppoſition or the fulneſſe of the Moone that is, by reckoning fourteene dayes, and ſixeteene houres, after the coniunction, a little thing more or leſſe.

The fourth Chapter, of a ſhort account or reckoning to know without the booke briefly the dayes which the mone hath in any moneth of the yeere.

OF the account of the Moone which before hath beene declared, you may at all times when you will, knowe howe many dayes old the Moone is, and what day and houre the coniunction was, but becauſe without the booke it cannot be knowne. I thought here to put a ſhort account, that by memory it may be known, how many daies old the moone is, at al times when you would know it: the which is to be reckoned in this manner.

In what day ſoeuer you are in, look how many be of concurrent in that yeere which you runne, according as you ſhall find in the account before written, and ioyne with them the number of the monthes which are paſt from March vnto that moneth, and likewiſe ioyne the daies of the moneth which you haue vnto the day wherein you are: theſe three numbers together if they paſſe of thirtie, thoſe which are more, the Moone is old, and if they be thirty iuſt, the Moone is in coniunction, and if they come not to thirty, thoſe which are, ſo many dayes old the Moone is.

An Example,

In the yeere of 1545. we haue ſeuenteene of concurrent, therefore the twentie of Auguſt, I will knowe howe many dayes olde the Moone is: I ſay that of concurrent is ſeuenteene, ioyne fiue of the monthes which are from March to Auguſt, it amounteth to twentie three, and twentie of the month are forty three, take away thirtie, there remayneth thirteene, ſo many dayes the Moone is olde, the twentie day of Auguſt. And by this maner you ſhall take out the dayes that the Moone is olde, euerie time that you will.

1545.	17	28	9	20	1	12	13	
4	15	26	7	18	29	11		
	22	314	25	6				

In the yeere of 1545. we haue ſeuenteene of concurrent, the next yeere following, wee haue twentie eight, and ſo reckoning in euery yeere one houſe of theſe and it ſerueth for euer.

OF this account of the concurrent, knowe yee, that it increaſeth euery yeere eleuen, and it cannot paſſe aboue thirtie, and if they doe paſſe thirty, you muſt leaue the thirtie, and take that which remayneth. And to knowe this reckoning of the concurrent quickly by the head, doe you in this manner ſet downe in the roote of the thumbe, ten, and in the ioynt of the middeſt twenty, and the vppermoſt thirty, and this being done, put the Golden nnmber in the three ioynts, reckoning one in the roote of the thumbe, and in the middle ioynt, two, and aboue three, and turning againe beneath foure, and in the middeſt fiue, and ſo diſcourſing vntil you come to the golden number of that yere, and if it ſtay in the roote of the thumbe you ſhal ioyne that which it is of golden number, with the teene that was put there, and ioyning one number with as many more: you ſhall haue of concurrent as much as both numbers doth amount to, and if the Golden number doe reſt in the middle ioynt you ſhall ioyne with the Golden number, the twenty that was put there, and al being ioyned together, it will be ſo many of concurrent, and if the Golden number, doe reſt in the vppermoſt part of the thumbe, ioyne with the Golden number, the thirty, which was put there, hauing alwayes remembrance, when all the number doe paſſe thirty, you ſhall leaue the thirty, and that which remayneth, is the concurrent.

The fifth Chapter how by the dayes of the Moone, and the courſe where the Sunne will be, ſhall be knowne at what houre the tyde will come euery day.

ALl perſons which doe ſaile, it is neceſſary that they know how the tides doe fal euery day, and at what hour it is ful ſea, or low water, for this is conuenient, aſwel for to enter in by any hard hauen, as for other things, which may ſerue in the Nauigation.

Therefore in this Chapter, I will declare, how the reckoning of the ſaid tides ought to be kept, and at what houre they come, for to profit thereby, of the which is to be vnderſtood, that the Moone goeth the thirtie two winds of the Nauigation in 24. houres, in the which ſhee maketh her dayly mooning,

with more that shee hath gone of her owne mooning, and in this time shee bringeth two tides, that is to say, two floodes and two ebbes, so that the Sea floweth fiue houres, and ebbeth other fiue, which are twelue, and the like is done in other twelue, but it is to bee noted, that these flowinges and ebbinges are not equall, nor alike in all times and places, as much as toucheth the time they be not equall, because seuen dayes the waters goe rising, and we call them spring tydes, and other seuen they goe decreasing or fayling, and we call them neape tydes: so that from the first day of the Moone vnto the eight day, which is the quarter, the waters goe decreasing, and from the quarter vnto the fifteene which is the full Moone, they goe increasing, and from the full Moone to the thirde quarter, they goe decreasing, and from that to the coniunction they goe increasing: and declaring this more at large, I say that the first day of the Moone, is the head of the water, and the seconde day, the encreasing is as great, and the thirde day well neere the like, and the fourth day it decreaseth, and so it goeth euery day decreasing, vntill the Moone be eight dayes olde, and then it is altogether neape tydes: and the nieuth is the like, and the tenth well neere alike. The eleuenth it beginneth to encrease some thing, and so it goeth encreasing euery day vnto the fifteenth which is full Moone, which doth turne to bee the heade of the water. And the sirteenth it increaseth the like, and the seuenteene well neere the like. The eighteenth it decreaseth, and so it goeth decreesing euery day vnto the two and twentie, which is altogeather neape tydes, and the three and twentie it is the poynt of the water, and goeth increasing vnto the thirtie day which is the coniunction. And the first day it turneth to bee the heade of the water, and so successiuely, it goeth increasing and decreasing as it hath bene declared: Likewise it is to be vnderstoode that these increasinges, are not at all times equall or alike, but in some Moones they are greater and in other some lesser, as by experience we see.

Likewise it is to be noted, that these increasinges and decreasinges in all places are not alike, for the causes that I will speake of.

And for to know the houre, when the tides doe come, it is to be vnderstood, that alwayes the Moone beeing in the Northeast it is full Sea, and in the Southeast low water, and in the Southwest ful Sea, and in the Northwest low water.

And to know when the Moone is in euery one of these courses, it must bee taken out by the course where the Sunne is in this manner.

The first day, of the Moone, the Sun being in the Northeast and by East, the Moone is in the Northeast, and that houre full Sea.

The seconde day, of the Moone, the Sunne being in the Northeast is full Sea.

The

The thirde day, when the Sunne is in the East and by North it wilbe full Sea.

The fourth day, the Sunne in the East full Sea.

The fifth daye, the Sunne in the East, and by South, the Moone in the Northeast.

The sixte day, the Sunne in the Southeast, the Moone in the Northeast.

The seuenth day, the Sunne in the Southeast, and by East, the Moone in the Northeast.

The eight day, the Sunne in the Southeast, the Moone in the Northeast.

The nienth day the Sunne in the Southeast and by South, the Moone in the Northeast.

The teuth day, the Sunne in the South Southeast, the Moone in the Northeast.

The eleuenth day, the Sunne in the South, and by East, the Moone in the Northeast.

The twelfth day, the Sunne in the South, the Moone in the Northeast.

The thirteenth day, the Sunne in the South, and by West, the Moone in the Northwest.

The fourteenth day, the Sunne in the South, Southwest, the Moone in the Northwest,

The fifteenth day, this day we reckon two quarters togeather, by reason that the poyntes are thirtie two, and the dayes thirty, we giue in the middest one quarter, and in the ende another, so that at the fifteenth day the Sun being in the Southwest, the Moone will be in the Northeast, and this houre it will be full Sea.

The sixteenth day, the Sunne being in the Southwest and by west, the Moone will be in the Southwest, and that houre will be full Sea.

The seuenteenth day, the Sunne in the West Southwest, the Moone in the Southwest is full Sea.

The eighteenth day, the Sunne in the West, and by South, the Moone in the Southwest full Sea.

The nineteenth day, the Sunne in the West, the Moone in the Southwest, full Sea.

The twentieth day, the Sunne in the West, and by North, the Moone in the Southwest.

The twentie one day, the Sunne in the West, Northwest, the Moone in the Southwest.

The twenty two day, the Sun in the Northwest, and by west the moone in the Southwest.

The

The twentie three day, the Sunne in the Northwest, the Moone in the Southwest.

The twentie foure day, the Sunne in the Northwest, and by North, the Moone in the Southwest.

The twentie fiue day, the Sunne in the Nor Northwest, the Moone in the Southwest.

The twentie sixe day, the Suune in the North and by West, the Moone in the Southwest.

The 27. day, the Sunne in the North, the moone is the Southwest.

The twenty eight day the Sunne in the North and by East, the Moone in the Southwest.

The twentie nine day, the Sunne at North Northeast, the Moone at Southwest, and at that houre full Sea.

The thirtie day, which is the coniunction is to be reckoned tow poynts, which are the Northeast and by North, and the Northeast.

The sixte Chapter, wherein is declared more at large, the aforesayde Chapter, with a demonstration.

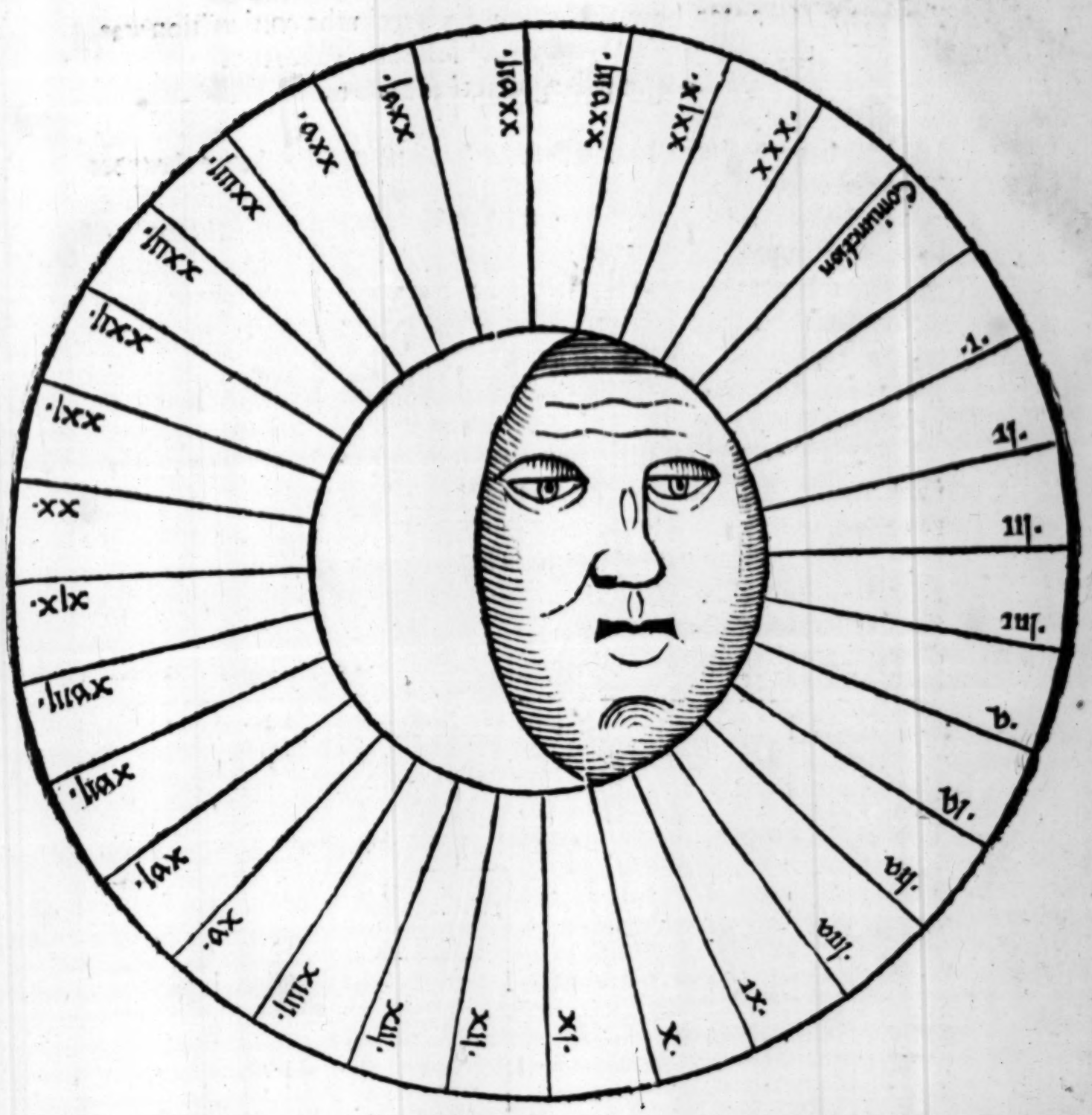
OF the account which before hath beene declared, you shall take out euery day at what houre the tyde commeth, the Sunne beeing in the poynt or course as before is mentioned. But for the better vnderstanding hereof, it is to be noted, that alwayes at twelue of the clocke in the day you haue the Sunne at South, if you bee more towardes the North then the Sunne, so that at sixe of the clocke in the morning you had it at East, and at nine at Southeast, and at three after the middest of the day, you shall haue it at Southwest, and at sixe, at West, and at nine, at Northwest, and at twelue of the night, at North.

And at three after midnight at Northeast, and if the Sun be more towards the North, then at the middest of the day, you shall haue him at North, and at twelue of the night at South. And by these courses you shall take out the rest, according to the place and time, wherein you shall find your selfe. Likewise it is to be noted, as before hath beene declared.

The Moone being in the Northeast or Southwest, it is full Sea, and in the Southeast and Northwest, it is low water. And to know when hee is in these courses, the course must be sought where the Sunne should stand according as the dayes of the Moone are.

And of this is vnderstood that although here goeth written, the courses where the Sun ought to be, because the Moone should be in the Northeast, and that houre full sea. Likewise it is to bee vnderstood, that the Sunne being in the contrary course of that, the moone will bee in the Southwest, and it will bee likewise full Sea, and the like will be at the low water. And in this sort the account serueth, as well for the first tide as for the second, the which maye be taken out by the figure following.

Of



Of this figure is to bee noted, that being knowne how many dayes the Moone is old, and seeking it in this account, and the Sunne being come to that course, where the like number is, or to his contrary, that houre will be full sea; keeping reckoning that at twelue of the clocke of the day the Sunne is at South, and at twelue of the night at North: And that in three quarters of an houre the Sunne passeth from one poynt to another.

The

The seuenth Chapter, how by the houre wherein the coniunction was, the tyde may be knowne, and the allowance that ought to be giuen to the riuers.

IT hath beene declared, how it shall be knowne, at what houre the tydes come euery day, by counting the number of daies of the Moone, and by that meanes looking in the course where the Sunne should be, as in the chapters before written hath beene declared. And besides this, it seemed good to me, to put here a rule, and account, because not onely by the dyaes of the Moone, and courses of the Sunne, but by the houres, the houre being known wherein the coniunction was shall be knowne euerie day, at what houre of the day or the night, the tyde will come: and for this you must know the account following.

Looke in what day and what houre the Moone was in coniunction, and being knowne, you shall find that euery day the tide doth come foure quintos or foure fiue partes of an houre forward, so that if the tide come this day at one of the clocke, to morrow he will come at one and foure fiue parts of an houre, and the nert day at two, and three fiue partes, and so the rest of the dayes as by this account appeareth:

Dayes.	Houres.	Fifthes.
1		4
2	1	3
3	2	2
4	3	1
5	4	
6	4	4
7	5	3
8	6	2
6	7	1
10	8	
12	8	4
12	9	3
13	10	2
14	11	1
15	12	
16	12	4
17	13	3
18	14	2
19	15	1
20	16	
21	16	4
22	17	3
23	18	2
24	19	1
25	20	
26	20	4
27	21	3
28	22	2
29	23	1
30	24	

IT is to be noted that the houres here written, being ioyned with the hours of the Moone which shee hath in the coniunction, besides those dayes that be more then foure and twentie, there shall be taked out once twelue, or twise if it be needefull: and those which remayne shall be the houre wherein the tyde will come. Item it is to bee noted that the accountes which before hath beene declared, whereby may bee knowne at what houre the tyde will come, is as much as to the naturall course of the Moone, more it is so that accedentally, it is not in all partes, or in all coastes that the tydes are not equall, although they be in one Meridian, they come not so at one time, by reason of the great currents, or the straightes of the Sea, great gulfes, or entrance of land into the Sea, or windes, or for other cause, by the which alwaies the practise of the land ought to be looked vnto.

Likewise it is to be vnderstood, that there ought to be giuen allowance to the riuers, because they make not the tides according to the barre, and there should be giuen them allowance, a quarter later because in the coasts, the tide beginneth to ebbe more speedily, and in the riuers it cannot be done, by reason of the holding backe or stay of the waters that commeth from aboue, and the like is to be giuen at the flowing, this is common, but the allowance is not alwayes equall to all riuers, because some do flowe and ebbe more then other some.

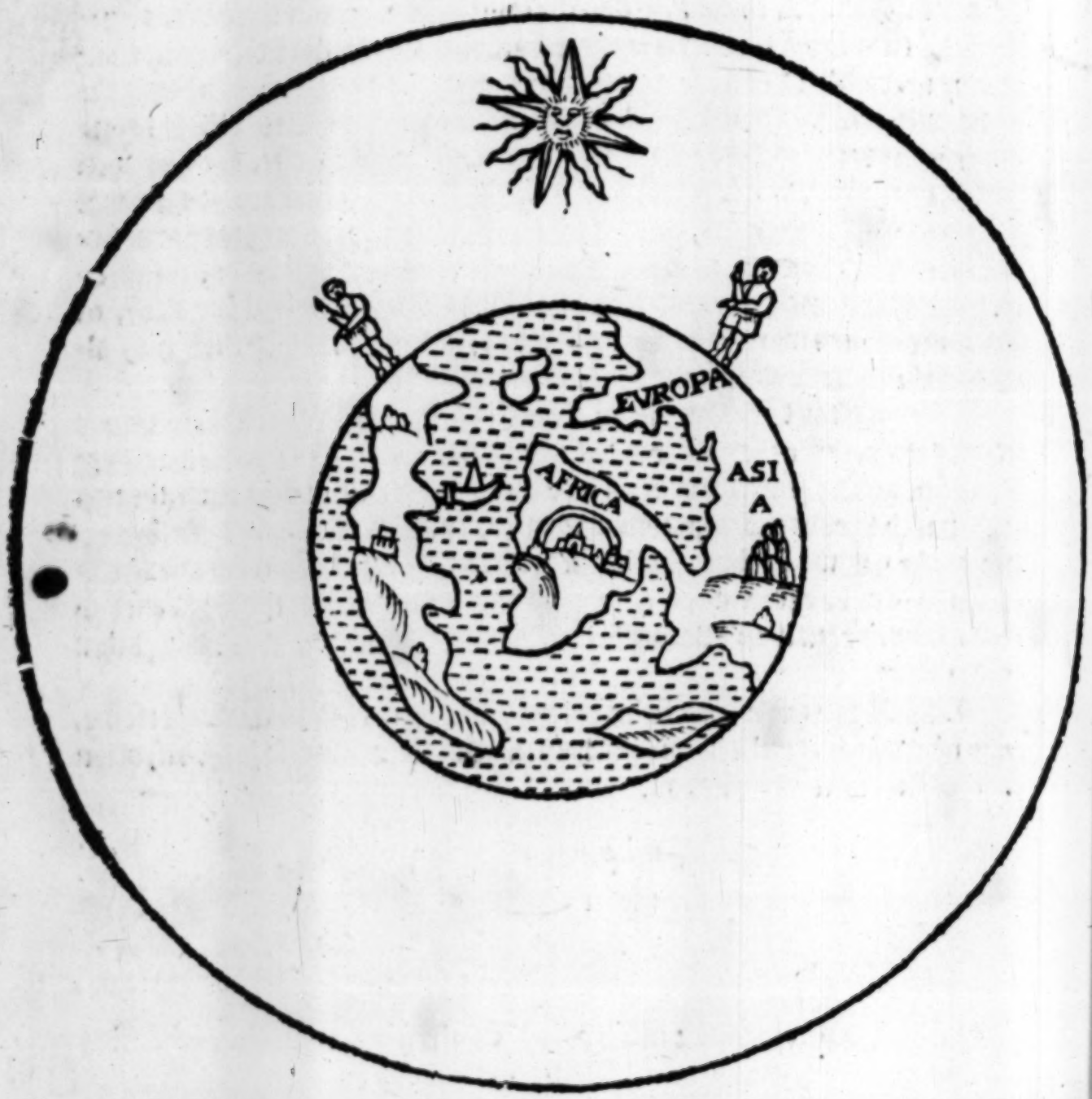
This is by reason that some riuers haue more current then other some, and likewise when the flowing is holpen with wind, therefore the disposition of the place is to be looked on.

The end of the seuenth booke.

The eight booke of the dayes of the yeere.

The first Chapter, What thing a day is, and howe it is reckoned, and in how many partes it is deuided.

THis name day, is taken in two sortes, that is to say, a naturall day, and an artificial day. The naturall day is a time of foure and twenty houres, and is called a natural day, because he is equall in all partes of the earth, habitable, the which day diuers nations doe reckon by different wayes. The Athenienses, and Egyptians doe reckon it from the setting of the Sunne, vntill the next day, at the same houre. The Greekes, Persians and Babilonians from the time that it riseth. The Romanes doe reckon it from mydnight. The Astronomers doe reckon it from the middest of one



one day to the middeſt of the next: the reaſon wherefore the Aſtronomers doe reckon them ſo, is that which Ptholome writeth in the ſecond and third of the Almageſte, and Alfragano in the eleuenth difference where they ſay, that the cauſe wherefore the Aſtronomers doe begin the naturall day, the Sunne being in the Meridian, and not when he riſeth, nor when he ſetteth, is becauſe the dayes in the riſing of the Sunne, and ſetting of him, are different according as euery habitation is neere, or diſtant of the Equinoctiall line, and the Meridians in all the habitations are vniforme, becauſe all of them

them doe passe by the Poles: so that the day is greater or lesser in one habitation then in other, because as it is equall, which the Sunne doth light in the Horizontes, Obliquos, so it is not equall in all partes, when hee riseth, and when he setteth.

In such sorte, that how much the variation of the Horizon is, so much is the variation of the dayes in length or shortnesse, and if this should be made euen for all Horizontes, it were conuenient, to haue for euery one a table of equalitie of the dayes, where shoulde bee well neere an infinite number, so that the Astronomers to flie so great aduersitie, began the day, in the middest of the day, because one is sufficient for all partes, and seeing that wee haue spoken of the naturall day, let vs speake also of the artificiall day.

The artificiall day is the time which the Sunne doth shew light vnto vs, going aboue our Hemispherio, and is called the artificiall day, because he is different in diuerse parts, and because the artificers doe make their works in him the which is deuided into four parts according to the foure differences, which the Sunne maketh. In the first he shineth, in the seconde hee hateth, in the thirde hee burneth, in the fourth he warneth, the night consequently hath foure partes. The firste is the firste sleepe, the seconde is midnight, when all thinges holde their peace, because it is no apt thing to worke any thing, the thirde when the Cocke croweth, the fourth when the day doth begin to appeare. There is another time called Cropusculo, and is, when it is neither day nor night: so betweene day and night, as betweene night and day.

This Cropusculo is that bright time, which we haue in the morning, before the Sunne riseth, as likewise that which we haue in the euening, after that the Sunne is set: vntill the darkenesse of the night doe come.

This Cropusculo is greater or lesser, according as the day is great or little, and so in the Sommer we haue a greater Cropusculo then in the winter, and in that parte it should be greater, where the dayes are greater, and so we see, that in Flaunders in the Sommer, at ten of the clocke in the night, although it be two houres after Sunne set, there is so much light, that any letter may be read.

The second Chapter, how in the artificiall day the Sunne riseth and setteth, differently to such as inhabite in the world.

IT hath beene declared, what thing a day is, and how the naturall day, and artificiall day, are vnderstoode. In this I will speake howe the Sunne comming foorth in the Horizon, and vp by our Hemispherio, commeth to the Meridian, and from thence descending, and commeth to the occident, where

where he setteth to vs, and as this is done indifferently to such as inhabite in the world, of the which it is to be vnderstood, that the going forth which the Sunne maketh, euery day by our Horizon, it is not equall one day with another, and this is true, experience doth shew it. And to be likewise so, the quãtity or greatnes is not equal one day with another, but of this is to be noted, ỹ in the degrees of distance of the equinoctial, wherin the Sun commeth forth euery day, in the same hee setteth, likewise it is to be noted, that although the day be great or little, alwayes a man being in one place, the sun commeth euery day, into one selfe Meridian. without any manner of variation

Likewise it is to bee vnderstoode, that because the Sunne commeth not forth equally at one time to all such as inhabite in the world, nor all of them doe see him at one time, so the middest of the day is not made at one time to all. In such sorte, that howe much the more any place is more easterly, then other, by such by so much, such as inhabite there, doe see the Sunne rather, and doth begin rather to appeare to them then to such as are more westerly. And in this manner successiuely, euen as the Sunne goeth rising aboue the Horizon of some, so he goeth shewing and appearing indifferent partes to others: so that when to vs it is in the middest of the day, such as are more westerly, to some it will be xi. a clocke, to others tenne, and to others nine. And so how much more distant he is of vs towardes the west, so much the later the Sunne commeth forth to them, and so by the sayde reason, hee commeth later to their Meridian, I say more late to our respect, and such which are from vs more easterly, because the Sunne came forth to them first, then to vs, they had the day first. And in this manner, is to be vnderstoode that at the 24. houres, that the Sunne goeth about the world, when to some it is day, to othersome it is night, and when to some it is morning, to others it is the euening, and when he riseth to some, he setteth to othersome, and when to some it is mydday, to others it is mydnight. This is because as the Sunne mooueth himselfe rounde about the worlde, and alwayes goeth lightening the halfe of the roundnesse, doth cause the sayd differences. And it is to be noted, that in the mooving which the Sunne maketh he mooueth euery houre by the roundnesse of the water and earth, 262. leagues, because the fire thousand three hundreth leagues beeing parted, which the roundnesse hath in the 24. houres of the naturall day, it commeth to euery houre 262. leagues. And so by this reckoning, looking what houre it is of the day in the place where a man is, he shall knowe what houre it is in any other parte, knowing the distance of the leagues, which are to that sayd place.

The third chapter, how that vnder the Equinoctial, the dayes and nights are alwayes equall.

It

IT was an opinion of some ancient writters, that vnder the Equinoctiall, and likewise all the Torrida Zona was inhabited, the which they beleeued, because that there the Sunne doth sende his perpenticuler beames, there should be such excessiue heate, that it was not habitable: of this opinion was Virgil and Ouid, and other singuler men. Others there were, which held that some part was habitable, following Ptholome, which in the booke that was compared to the arte of Sphera, sayth, it is not conuenient, that we should thinke the Torrida Zona to be altogether inhabitable. Other there were, which held that there it was not onely temperate, and without two much heate, but also most temperate. And this is affirmed by Saint Isidore in the first of the Etimologias, where he sayth that the earthly Paradise is in the East part vnder the Equinoctiall, a most temperate place and Ptholome likewise saith in the third of the Quadri partiti, that all the temperate complections doe proceede of the Equinoctiall. The experience doth now shewe vs, that not onely vnder the Equinoctiall, but all the Torrida which is from one Tropike to the other, is habitable, rich, and plentifull, because well neere all the yeere, the dayes and nightes are almost equall: so that the freshnesse of the night, doth temper the heate of the day, and so continually the earth hath season to bring coyth and increase her fruites.

But it is to be noted, that touching the equality of the dayes and the nightes, there may be had a doubt, and say that the Sun in no time doth make equalitie, of the day with the night, but alwayes the artificiall day is greater then the night by these reasons following.

A doubt.

It is certayne that a shining body being greater, lighteth the darkenesse more then the halfe, and as the Sunne is greater then all the earth, so that as it hath beene sayde, that it is the opinion of Alfragano in the difference twentie two, that the Sunne is one hundreth sixtye sixe times greater then the earth, so that the Sunne doth light the earth more then the halfe.

The lesser parte remayning darke, in such sorte, that the Sunne is seene in a greater parte of the earth, then in that parte where he is hidde, and as the presence of the Sunne is cause of the day, and his absence causeth the night, it followeth, that the Sunne neuer maketh equality of the day, and of the night. Likewise the aforesayde is proued, wherein a case is giuen, that the halfe of the Equinoctiall, is aboue the Horizon, and the other halfe beneath, for the greatnesse of the Sunne is the greater parte where he lighteth, then in that which he hideth himselfe: it seemeth euident, that the part

is greater that the Sunne lighteth, then that which he leaueth darke. By the which reasons is prooued that the Sunne maketh not equalitie of the day with the night.

A declaration.

Contrary to that which is sayd are many reasons, I will speake of three in shorte time.

The first is, the[illegible]ur sight doth manifest, how all dayes are not equall, but some dayes greater, and some lesser, by the which whereseoeuer is giuen greater and lesser, is likewise necessary that there be giuen an equality, so that as there is a day greater then the night, and a night greater then the day, of necessity must be giuen night and day equall, because it cannot passe from one extremitie to another, but by the meane:

To the seconde, the Philosopher sayth in the first of the naturall Philosophie, that the Sunne being come to the Equinoctiall, the mooving which he maket haboue the earth, is equall with that which he maketh vnder. And in like sorte, the time of the day is equall with the time of the night.

The thirde, answering to the reasons aforesayd, I say that it is true, that the Sunne lighteth more then halfe the earth, as the perspectiue reason sheweth it, but it is to be denied, that the day in the Equinoctiall is greater then the night, not because whensoeuer any parte of the Sunne is seene, the day beginneth, but it beginneth when the Center of the Sunne commeth foorth, and not the partes circumferentials. And so likewise when he setteth, the night beginneth. The reason is because the Planets, and the starres doe occupie a great quantitie, and their place, and mooving is not to bee taken, by any manner of parte, but it ought to be taken by the Center, and so it is sayde that the Sunne is in the Equinoctiall, when his Center is there.

The fourth Chapter, how the dayes and nightes goe alwayes increasing or diminishing vnto such as inhabite of the Equinoctial.

IN the first Chapter of the fourth booke hath beene declared, that from the Equinoctiall, to the Pole Articke is called the North parte, and from the Equinoctiall to the Pole Antarticke, is called the South parte: Therefore it is to be vnderstood, that such as inhabite from the Equinoctiall, towardes the North parte, or the Pole Articke, as the Sunne commeth to the tropike of Capricorne, the thirteenth of December, and so beginneth to returne to the line, howe much hee commeth from the sayde Tropike, so much the dayes goe encreasing, and to such as inhabite towards the South

part

part they goe decreasing. And the Sun being come to Aries the eleuenth of March, hee describeth the Equinoctiall line, and maketh in all partes the dayes and nightes equall, and being past the first poynt of Aries, the dayes begin to waxe greater then the nightes, and to those of the other parte, the dayes lesser, and the nightes greater, and the Sunne beeing come to Cancer the eleuenth of June, the day is greater, and the night lesser, and to the other parte the contrary: for then the Sun is more neere to some and more distant to other some, and from thence the Sunne turneth to descend, and as he goeth away from that parte, the dayes goe decreasing, and the nights increasing, and being come to Libra, the thirteenth of September, he returneth to describe the Equinoctiall, and the dayes and the nightes are to all equall, and from thence he goeth descending to Capricorne, and the nights begin to be greater then the dayes, and towardes the South part, the daies greater, and the nightes lesser, and as he commeth to the sayd tropike, it maketh a greater night, and a lesser day, and to those of the other part, the day greater, and the night lesser, for there the Sunne goeth more distant from some, and commeth neerer to other some.

Whereby it is to be noted, that if there be taken two dayes of the yeere, equally distant of the Equinoctiall line, of contrary partes that howe great the artificiall day is of the one, so great the artificiall night is of the other. Likewise it is to be vnderstood, that how much in euery habitation, the pole is more rayse aboue the Horizon, so much the dayes and the nightes are greater, so that those whose zenith is in the circle Articke. To whom the Pole riseth aboue the Horizon, fortie fiue degrees and a halfe, when the Sunne commeth to the firste poynte of Cancer, the eleuenth of June is to them one day twenty foure houres, and the night very short, because in one moment the Sunne toucheth that day his Horizon and imediatly commeth foorth, and that touching they haue for night. And the thirteenth of December, when the Sunne commeth to the first degree of Capricorne, then he is to them a night of twentie foure houres, and a little moment for the day, for in one instant, the Sunne toucheth his Horizon, and forthwith he hideth himselfe, and that touching they haue for a day, by the contrarie, such as inhabite vnder the circle Antarticke, haue the like. And those whose Zenith is betweene the circle and the Pole of the worlde, whiles the Sun goeth towardes the North parte, it will be to him one day, that which his Horizon doth discouer of the Equinoctiall, continually without night, and if they were of quantitie of one signe that day would be of one Moneth. And of two signes, it would bee of two Monethes, and so the rest: and hee that were vnder any of the Poles, all the yeere would bee to him one day and one night: In such sorte, that if he were vnder the Pole Articke, the sixe monethes which the Sunne goeth to the parte of the North, would be to

him one day without any night, and the other fire which he goeth towardes the parte of the South, would be one night, without day, and so contrarie it would be, if he were vnder the Pole Antarticke, so that halfe the yeere, it would be to him one day, and the other halfe one night. The cause is, by the reason of the roundnesse of the worlde, howe much it goeth towardes the Poles, so much it goeth to be lesser, and so the Horizon of such as are neerest to the Poles doth discouer more parte to the turne which the Sun giueth in the heauen, when he goeth from that parte: In such sorte, that the earth, nor the water, doth not occupie the sight of the Sunne, all the time that he goeth rising vp, and turneth descending, vntill hee commeth where his Horizon doth not discouer any thing of the circle or turne, that he maketh to the worlde, and so how much more, the part which is seene of sim this turne, so much the day will be greater.

The fifth Chapter, howe the increasing and diminishing of all partes are not alike.

Many things are put in the common opinion of the people that reason, and truth doth shew it to be in another manner. And among other, one is that many doe thinke that the increasing, and decreasing of the dayes through all the yeere are made equall, I will saye that the time, which those dayes goe increasing, so much increaseth one daye as another, and so when the decrease euen by the like sort.

And according to the quantitie of houres, which the day increaseth, from the lesser day to the greater, those being parted by the time of the 6. months, which the day doth increase, they consider how much it is that it increaseth euery day, giuing equall number or quantity of time to one day, and so much to another. And likewise when the day goeth decreasing how much it is that it decreaseth: in such sort, that the lesser day, hauing 9. houres, and the greater 15. these 6. houres which he increaseth, deuided into 6. Monethes, the dayes should increase one houre euery moneth. And so by the contrary in other fire monthes, it would decrease an houre euery moneth: (This is not so) for in truth only in the month of March, the dayes doe increase as much as they did increase in the 2. monthes of Januarie and Februarye, and by the contrarye, they doe decrease so much in the onely moneth of September, as they doe decrease in July and August: also in the Kalenders, in the head of all the Moneths is written, that the dayes haue in euery moneth, so many houres, and the night so many. Of this is to be vnderstood, that neither the daies are equal in all the moneth, nor the number of the houres are one in all places. For in the city of Ciuill, the daies are of one quantity, and in Tolido, of another, and in Burgius another, & so proceeding to the place wher the day is of 24. hours: so that the dayes of euery moneth be not equall in hours, nor the dayes be not equall in all parts, the cause is, as the Sun maketh difference from one moneth to another in comming neere, or going from the Equinoctial line, so the

daies

dayes, goe increasing or diminishing, this comming neere, or going alway of the Sunne, he doth it not alwayes alike, but he doth it in this manner.

From the 12. of March, that he goeth forth of the Equinoctiall, he beginneth to rise vp, by the part of the North, from thence vntil the 12. of Aprill, he hath gone from the said line, 12. degrees, and from the 12. of Aprill, to the 12. of May, he hath gone distant other 8. degrees, and from the 12 of May, to the 11. of June, which he commeth to the Tropike, he goeth distant other three degrees and a halfe, which are in all 23. degrees and a halfe, which the Sunne hath of declination or distance, from the said line, in such sort, that the first moneth he goeth distant, the halfe of the sayd declination, and the second moneth the third part, and the third, the first part, and so in the increasing of the dates. The 11. of March, the dates and nightes are equall, and from thence to the 11. of Aprill, the day increaseth halfe of all the time that he will increase, and from the 12. of Aprill to the 12. of May, he increaseth the third part, and from the 12 of May to the 11 of June, he increaseth the first part, whereby that in the straight course, where the greatest day hath 15. hours the 12. of march, it hath 12. and the 12 of Aprill, 13. and a half, and the 12. of May 14. and a halfe and to the 11. of June 15. And by this reason in the straight course, wher the greatest day hath 16. houres, and in him where he hath 14. or more, or lesse: the 12. of May, or in any other day, except in the Equinoctials, the dates will not be equall, but one wilbe greater then another, in such sorte, that the day hath more increased to them which haue 16. houres then to them which haue 14. so that such as haue 16. the 12. of May, the day hath increased 2. houres, and to such as haue 14. it hath not increased more then one, And as the day went increasing at the rising of the Sunne, so he returneth diminishing or decreasing, when he descendeth. And so the reckonng ought to be kept in all parts, according to the quantity of the time and hours, which the greatest day hath.

And it is to be noted, that how much the day increaseth of twelue houres vpward: so much he decreaseth of twelue houres downewarde, therefore to knowe the quantitie of houres, and pointes that the greatest day of the yeere hath in euery degree of distance of the Equinoctiall line: In the table here after written, shall be declared, the which is likewise to be vnderstood for the part of the South, as for the part of the North.

And it is to be known what day it is called in this reckoning from the time that halfe the body of the Sunne riseth, vntill the other halfe be set, and all the other is night, also the houres or parts of the day are not vnderstoode by the twelfth part of the day, or of the night, but by these vulgar thinges of the clocke, for by another name they are called Equinoctials: for in euery one of them riseth 15. degrees of the Equinoctiall, and other fifteene setteth. And likewise it is to be vnderstood, that in this account threescore points or minutes doe make an houre, and thirty, halfe an houre, And so of the rest.

A Table of the houres, and minutes which the greateſt day of the yere hath, to ſuch as inhabit in any manner of diſtance of the Equinoctial.

Deg.	Hour.	Min.
1	12	1
2	12	3
3	12	5
4	12	8
5	12	12
6	12	17
7	12	21
8	12	25
9	12	29
10	12	34
11	12	40
12	12	45
13	12	49
14	12	54
15	12	57
16	13	0
17	13	4
18	13	7
19	13	11
20	13	15
21	13	19
22	13	23

Deg.	Hour.	Min.
23	13	27
24	13	30
25	13	34
26	13	39
27	13	43
28	13	48
29	13	52
30	13	57
31	14	2
32	14	7
33	14	12
34	14	17
35	14	22
36	14	27
37	14	32
38	14	38
39	14	45
40	14	52
41	14	59
42	15	6
43	15	12
44	15	19

Deg.	Hour	Min.
45	15	27
46	15	33
47	15	40
48	15	50
49	16	2
50	16	11
51	16	22
52	16	34
53	16	45
54	17	0
55	17	15
56	17	30
57	17	45
58	18	0
59	18	20
60	18	40
61	19	0
62	19	30
63	20	0
64	21	0
65	22	0
66	23	0
66 m	24	0

The sixte Chapter of the houres, poyntes or minutes, that euery day of the yeere hath in the Altitude of fortie degrees.

IN the table before written, hath beene declared the number of the houres and minutes, or poyntes that the greatest day of the yeere hath in any manner of distance of the Equinoctiall line, and because it is likewise profitable, to knowe the houres and poyntes, that successiuely, euerie day in the yeere, hath in euerie parte. But for to make this apparant, to all persons, it were needefull to haue many tables. Therefore this is only taken out for the altitude of 40. degrees, where the greatest day hath foureteene houres, and fiftie two minutes, which are well neere fifteene houres. For in this Altitude, is the middest of Spayne, so that with little difference or more or lesse, it may serue in all Spayne.

In the other partes may bee taken out the reckoning, according to the greatnesse of the greatest day, agreeable to the Table before written.

Ianuarie.		
Dayes	Houres	Poyntes.
1	9	22
2	9	23
3	9	24
4	9	25
5	9	26
6	9	28
7	9	30
8	9	32
9	9	34
10	9	36
11	9	38
12	9	40
13	9	42
14	9	44
15	9	46
16	9	48
17	9	50
18	9	52
19	9	54
20	9	57
21	9	0
22	10	2
23	10	4
24	10	6
25	10	8
26	10	10
27	10	12
28	10	15
29	10	16
30	10	18
31	10	20

Februarie.		
Daies	Hours	Points
1	10	22
2	10	24
3	10	26
4	10	29
5	10	32
6	10	34
7	10	37
8	10	40
9	10	42
10	10	44
11	10	46
12	10	48
13	10	50
14	10	53
15	10	56
16	10	59
17	11	4
18	11	7
19	11	10
20	11	12
21	11	15
22	11	18
23	11	20
24	11	23
25	11	26
26	11	28
27	11	30
28	11	32

March.		
Daies	Houres	points
1	11	34
2	11	36
3	11	39
4	11	42
5	11	44
6	11	47
7	11	50
8	11	53
9	11	56
10	11	59
11	12	2
12	12	4
13	12	8
14	12	11
15	12	14
16	12	16
17	12	18
18	12	21
19	12	24
20	12	26
21	12	29
22	12	32
23	12	35
24	12	37
25	12	39
26	12	41
27	12	43
28	12	45
29	12	48
30	12	50
31	12	53

Aprill.		
Dayes	Houres	poynts
1	12	56
2	12	59
3	13	2
4	13	4
5	13	6
6	13	9
7	13	12
8	13	14
9	13	16
10	13	18
11	13	20
12	13	22
13	13	24
14	13	26
15	13	28
16	13	31

17	13	34
18	13	36
19	13	39
20	13	42
21	13	44
22	13	46
23	13	48
24	13	50
25	13	52
26	13	54
27	13	56
28	13	58
29	14	
30	14	2

May.

Dayes	Houres	poynts
1	14	4
2	14	6
3	14	8
4	14	10
5	14	12
6	14	14
7	14	16
8	14	18
9	14	20
10	14	22
11	14	24
12	14	26
13	14	27
14	14	28
15	14	29
16	14	30
17	14	32
18	14	33
19	14	34
20	14	36
21	14	38
22	14	39
23	14	40
24	14	41
25	14	42
26	14	43
27	14	44
28	14	45
29	14	45
30	14	46
31	14	46

June.

Dayes	Houres	poynts
1	14	47
2	14	47
3	14	48
4	14	48
5	14	49
6	14	49
7	14	49
8	14	50
9	14	50
10	14	51
11	14	52
12	14	52
13	14	52
14	14	51
15	14	50
16	14	50
17	14	49
18	14	49
19	14	48
20	14	48
21	14	47
22	14	47
23	14	46
24	14	46
25	14	45
26	14	45
27	14	44
28	14	43
29	14	42
30	14	41

July.

Dayes	Houres	poynts
1	14	40
2	14	39
3	14	38
4	14	37
5	14	36
6	14	35
7	14	34
8	14	33
9	14	31
10	14	30
11	14	28

12	14	26
13	14	25
14	14	24
15	14	22
16	14	20
17	14	18
18	14	16
19	14	14
20	14	12
21	14	10
22	14	8
23	14	6
24	14	4
25	14	2
26	14	1
27	14	0
28	13	59
29	13	58
30	13	56
31	13	54

August

Dayes	Houres	poynts
1	13	50
2	13	48
3	13	46
4	13	44
5	13	42
6	13	39
7	13	36
8	13	34
9	13	32
10	13	30
11	13	28
12	13	26
13	13	24
14	13	22
15	13	20
16	13	18
17	13	16
18	13	14
19	13	12
20	13	9
21	13	6
22	13	4
23	13	1
24	12	59
25	12	56
26	12	53
27	12	50
28	12	48
29	12	46
30	12	43
31	12	40

September.

Dayes	Houres	poynts
1	12	38
2	12	33
3	13	22
4	11	26
5	12	
6	12	23
7	12	17
8	12	15
9	12	11
10	12	7
11	12	4
12	12	2
13	12	0
14	11	59
15	11	57
16	11	55
17	11	52
18	11	49
19	11	46
20	11	44
21	11	41
22	11	38
23	11	36
24	11	33
25	11	30
26	11	28
27	11	25
28	11	22
29	11	20
30	11	17

October.

Dayes	Houres	poynts
1	11	15

2	11	12
3	11	9
4	11	6
5	11	4
6	11	1
7	10	58
8	10	56
9	10	53
10	10	50
11	10	48
12	10	46
13	10	44
14	10	42
15	10	39
16	10	36
17	10	34
18	10	31
19	10	29
20	10	26
21	10	23
22	10	43
23	10	18
24	10	16
25	10	14
26	10	12
27	10	10
28	10	8
29	10	6
30	10	4
31	10	2

Nouember.

Dayes	Houres	poyntes
1	10	
2	9	58
3	9	56
4	9	54
5	9	5
6	9	50
7	9	34
8	9	46
9	9	44
10	9	42
11	9	40
12	9	38
13	9	36
14	9	34
15	9	33
16	9	32
17	9	30
18	9	28
19	9	26
20	9	24
21	9	23
22	9	22
23	9	21
24	9	20
25	9	19
26	9	18
27	9	17
28	9	17
29	9	16
30	9	16

December.

Dayes	Houres	poyntes
1	9	15
2	9	15
3	9	14
4	9	14
5	9	13
6	9	12
7	9	11
8	9	11
9	9	10
10	9	9
11	9	9
12	9	8
13	9	8
14	9	8
15	9	9
16	9	9
17	9	10
18	9	10
19	9	11
20	9	12
21	9	13
22	9	13
23	9	14
24	9	14
25	9	15
26	9	16
27	9	17
28	9	18
29	9	19
30	9	20
31	9	21

The ſeuenth Chapter of the houre, and pointe which the Sunne riſeth and ſetteth in euery one day of the yeere.

AND ſeeing there hath beene declared in the Chapter going before, the houres and minutes which euery day hath, it is conuenient to ſpeake in this at what houre and minute the Sunne riſeth and ſetteth, in euery day of the yeere: for the which firſt of all, is to be noted, that for to take out the houre when the Sunne ſhall riſe, is to be reckoned from twelue of the clock in the night. And the hour when it ſhal ſet, is to be reckoned from twelue of the clocke in the day. Therefore looke ouer the houres and poyntes which the Sunne hath, and deuide them in the middeſt, and that which one halfe doth amount to, take it out of twelue, and that which remayneth ſhall be the houre, wherein the Sunne riſeth, and the ſame halfe ſhalbe the houre wherein the Sunne ſetteth, ſo that when he riſeth take out of twelue halfe of the number which the day hath: And to that which remayneth, is the point, where the Sunne riſeth and ſetteth himſelfe after the middeſt of the day, as the point which is halfe of the number that the day hath.

An Example.

The firſt day of Ianuarie, he hath nine houres, and 22 points, halfe this is 4. houres, and fortie one pointes, therefore theſe foure houres, and fortie one points taken out of 12. hours, remaineth 7. houres and nineteene points, and ſo the firſt day of Ianuarie the Sunne commeth forth at 7. of the clocke, and nienteene points after midnight, and ſetteth at four of the clocke, and forty one points, after the middeſt of the day, which was halfe the number that the day hath.

The eight Chapter, how the Sunne giueth his light at equall time of the yeere to ſuch as inhabite in the world.

IN the rules and accountes before declared, there might be a doubt ſaying, ſeeing that in ſome partes of woꝛlde, the dayes bee greate, and in other partes little, let vs ſee if in any one part of the woꝛld the Sunne ſhineth in al the yere moꝛe time then in the other. To this is to be noted, that although it be true, that in ſome part of the woꝛld, and times of the yeere, the daies and nightes bee greater then in other ſome, it is to be taken, that the Sunne by his owne mooting, that he maketh in the yeere, at equall time of the yeere is ſeene and giueth light in all partes, ſo that as long time of the yeere bee is ſeene in the part where the dayes be little, as in the part where they be great, the which is knowne in this manner, conſider that which euery part hath in it, of the day, and that which it hath of the night in this manner, ſuch as inhabite vnder the Equinoctiall, as they haue continually, the dayes equall with

the

the nightes, euery one of them 12 houres, it is certayne that halfe the time of the yeere they haue day, and they see the Sunne, and he sheweth light to them, and the other halfe they haue night, that they see him not, and such as dwell in forty and two degrees which haue the greatest day of 15. hours, they haue also day of nine houres, and so as the day goeth increasing from 12, to 15. houres, so they come decreasing vnto nine, in such sorte that the sayd time, which they haue day, the same they haue of night, so consequently those which inhabite in sixtie degrees which haue the greatest day of twentie houres, they haue likewise day of foure houres, and as the Sun goeth lightning of them, and the dayes increasing vnto twenty houres, likewise they goe decreasing vntill the day bee no more but foure houres, and the night goeth increasing and diminishing the like. And of these which inhabite in sixtie sixe degrees and a halfe, haue the greatest day of twentie foure houres, likewise they haue night of the sayd twenty foure houres, and such as haue day of one moneth without night, haue likewise a moneth of night without day, and such as should haue sixe monethes of day night, should haue other sixe monethes of night without day, and so being considered which euery part hath of day, and being seene, that as much iustly it hath of night: So shall be found that not onely in the Torrida zona, by the which the Sunne continually mooueth, but likewise in the other partes very distant and farre off, and also vnder the poles themselues, so long time of the yeere it is that the Sunne is seene, as the time that he is not seene, in such sort, that the Sunne giueth his light in equall time in all partes, and not in one time more then another. So the omnipotent God, maker of the heauens, of the earth, and of al that is in them, did dispose and ordeine, whose name bee blessed, in the worlde of worldes. Amen.

The ende of this booke of Nauigation.

May the twenty one day.

God saue the Queene.

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